JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

The Apotheosis of the Light Charge.

WHEN Dr. W. B. Davidson read his paper last June before the Institution of Gas Engineers, on the results of work conducted on the Birmingham coal-test plant (for which paper we heartily congratulate him upon having been awarded by the Council the London Gold Medal), it was clearly understood that the communication was not so complete as the author had desired it to be, in view of the investigations he had in hand being still unfinished. In conjunction with Mr. G. C. Pearson, Dr. Davidson has now made a contribution to the proceedings of the Midland Junior Association which may be taken as an appendix to the Institution paper. The greater part of this supplementary paper is composed of a description of the methods of working the large coal-test plant at Birmingham, and of improvements that have been made in the plant equipment; while at the tail-end of the paper one small section is devoted to a brief account, with tabulated results, of additional experiments with the plant on light and heavy charges and short and long duration carbonization. In this short concluding portion, carbonizers will have greater interest than in all the remainder, interesting as the component parts of that remainder are.

At the same time, it is necessary for those who study the results to learn something of the coal-test plant with which Dr. Davidson and his colleague have been working; and this they can do by referring to the present and previously published information. The plant the experimenters know thoroughly; and they can regulate and work it with something like mechanical precision, and under conditions which cannot always be maintained in a retort-house, although probably capable of being realized under constant expert supervision. Among the new devices comprehended in the test-plant equipment is the counterbalanced type of retort-house governor, to which some further improvement in production over the old governor is ascribed. Certain it is the tests show that the new form does not suffer from certain of the drawbacks of the old type. A cone-fitted dip is described, by which sealing and unsealing can be effected at will; and there are several other features upon which the large test plant has permitted experiment to be made. By the work that has been carried on lately, it has been demonstrated (among other things) that the best way to operate the plant is to maintain as nearly as possible a level gauge in the retorts; no benefit being found to arise from the intermittent system of governing the retorts. Experiments have been conducted with a dry main; but admittedly they are not conclusive unless certain modifications are made—the result, under the circumstances, having been rather disconcerting. A trial of a liquor and of a tar seal under comparable conditions showed a lower make per ton of coal with the tar than with the liquor seal; but there was not the depreciation of illuminating power that is very generally regarded as inseparable from the tar seal. On the contrary, both the illuminating power and the calorific power were slightly better, though, taking the whole make per ton, the liquor seal shows a decided advantage in both respects. One other specially interesting point is that tests with the Beasley recording calorimeter, in comparison with tests on the same gas with a Junkers calorimeter, have an approximation that will give a large amount of confidence to the former instrument. The great value of this paper, read in conjunction with that presented at the meeting of the Institution in June, is that we have presented much useful information as to what to do and what to avoid in carrying out tests of a precise nature on coal testing for gas manufacture; and beyond this the value that may be expected to be derived by similar applications in ordinary working. We advisedly say "may be expected" in order to obtain the protection of a little qualification, as the experience is that retort-house foremen and men are not all Dr. Davidsons or Mr. Pearsons. On the other hand, it follows that what can be done with a test plant of this order can be, *cæteris paribus*, done with ordinary retort carbonizing plant.

This brings us to what will generally be regarded as the principal point of the paper read before the Midland Juniors. While not neglecting his colleague in the preparation of this communication, it may be said that it shows Dr. Davidson possessing more pronouncedly than ever the view that the asserted improved results from heavy charges and longer duration carbonization in horizontal retorts are nothing but myths—in other words, that, under regulated working, equally good results can be obtained with light charges and with shorter hour working. Now what is there about the Birmingham test plant that enables it to obtain results that gas men up and down the country say they cannot secure with their own carbonizing plant other than by using the heavy charge and the longer duration carbonization? What is there about their plants different from the Birmingham coal-test plant that prevents them realizing, with the lighter charges and the short carbonizing periods, the same results as are obtained with the Birmingham test plant? We are faced with something like an enigma here, for which there is no absolutely satisfactory answer to be found in the paper by Dr. Davidson and Mr. Pearson. If, however, these gentlemen are interrogated on the subject, they will without doubt say that there is nothing mysterious or obscure about it, and that if the carbonizer knows his coal, knows the right temperature at which to carbonize the particular coal, ascertains the right weight of charge for, and the proper pressure conditions in, his retorts, the light charge and short duration carbonization will, with the maintenance of the factors named at their correct points, do all that the diametrically opposite lines of working will do in the way of a large make per ton, with illuminating power and calorific power on equal lines. There is no questioning at all from Birmingham as to any part of the commercial or financial advantage that has accrued to the gas undertakings that have altered their methods of working; but Dr. Davidson's hardened belief, based upon his own experiments, is tantamount to a declaration that those undertakings that have gained all the advantage were not working correctly in the days of light charge and short period carbonization.

At the last Institution meeting, it was thought, by Mr. Charles Carpenter among others, that possibly some explanation of Dr. Davidson's experiences (which were so contrary to the run of modern experiences throughout the country) were due—perhaps partly, if not wholly—to the fact that the coal-test plant suffered serious limitations in not being under the control of the rapid mechanical operation that now obtains in up-to-date retort-houses. Dr. Davidson himself confessed that, with hand labour on the test plant, and using 12 cwt. charges, the retorts took about eight minutes to discharge and charge; but when carbonizing only some 6 cwt. charges, the work took about 3 minutes. He also acknowledged that it was not easy by handwork to leave a uniform passage over the coal with 12 cwt. charges; and that the tests with the heavier charges had not been satisfactory. By the time of the Midland Association meeting last October, Dr. Davidson had, however, got still more confident, and stated that he was "strongly of opinion that the yield of gas "depended on the size of the retort and on the temperature; "and beyond a certain limit one could not go. In other "words, there was a limit beyond which one could not do "better with heavier charges than with moderately light "ones." Now, in the Junior Association paper, we have an accentuated statement of the fixed belief: "The tests con-"firm the conclusions already arrived at—that filling, or "nearly filling, the horizontal retort effects no improvement "in gas production." The results of the tests represent a very curious inversion of the general tale of to-day. As the weight of charge went up (take coal "A" in the end tabulated statement as an example) from 6·49 to 13·41 cwts.

and the period of carbonization was prolonged from six to twelve hours, the make of gas steadily dropped, candle power and calorific power were slightly lower, the percentage of fuel increased, the gallons of liquor decreased, and the only infinitesimal advantage (if such it can be called) was in the quantity of tar made. No one can attack Dr. Davidson on the points of care and accuracy in working; but the question is, Has he got to the proper solution of the difference of experience—that it is principally a matter of correct temperature for the coal carbonized that is the secret of the equal results from light charges and short duration carbonization as from heavy charges and longer hour carbonization? At present there is something of a mystery attaching to this matter. It is a pity that Dr. Davidson cannot be got away from the Birmingham test plant, and be put in charge of the carbonizing operations of a small works with good retort plant, so as to see what would then be the experiences.

Eastern Counties Meeting—Flueless Radiators.

The matter of most general current interest to occupy the attention of the members of the Eastern Counties Gas Managers' Association last Friday was a paper by Mr. J. H. Brearley, on the "Heating of Flueless Rooms"—the paper, appendices, and discussion taken together being stored with good and instructive points. The author went to a large amount of pains over the preparation of the paper; and the stock of data that he presents will be of much value as an index to requirements in the heating and ventilation of halls, factories, workrooms, and such-like, where, as a rule, there is no chimney to assist in producing changes of the atmospheric conditions. But though Mr. Brearley went to great pains in framing paper and appendices, it is quite clear from the discussion that he was not altogether successful in satisfying those who heard him as to the exact position he was taking up. But those who have yet to read the interesting paper and the report of the discussion will find that Mr. Brearley's reply to the latter forms a very good preface to the former; and, after perusing it, there can be no mistake as to the views of the author.

It will, in the first place, be observed that Mr. Brearley was dealing with "flueless" rooms, or rather halls, workshops, and other places in which people assemble, and in which chimneys are not provided, and therefore places in which ordinary gas-fires, requiring a flue, cannot be employed. The whole question that Mr. Brearley raises is as to whether in any such flueless place—taking into account all theoretical considerations and calculations as to the toxic carbonic acid emanations of the occupants of the place, as to the innocuous carbonic acid production of flueless stoves, and as to the rate of air change necessary under certain conditions—the use is preferable of an interior flueless stove, or an externally placed gas-heated water-boiler, with pipes running inside the building, and radiators fixed where the heating is required. Mr. Brearley's mode of dealing with the subject, without any specific statement to the contrary, led others besides Mr. Thomas Glover to think that, in an "oblique way," he was condemning *in toto* the flueless gas-radiator for all purposes. But that was a mistake. He has a decided inclination towards the gas-heated water-boiler and circulator for flueless halls and other buildings; but there are unspecified situations where he would not deny the service of the flueless radiator. We suppose those situations are in halls and factories that, under the condition of maximum use, would come well within the several theoretical lines drawn in the appendices to the paper. However, when there is a fair appreciation of the author's attitude, then one can sail along with him in comfort through the paper, appreciate the points as one passes along, and at the same time award a large amount of credit for the very serviceable work the paper contains.

But it comes to this, that where halls and factory workrooms are flueless, then the stronger the reason for special consideration being paid to the ventilation; and where there is proper ventilation, there the combustion of gas for heating will not have any harmful effect. The gas industry must have a care, in connection with this matter of flueless heating, as to the attitude that is taken up, lest the stigma that is attached to it through ignorance of the real conditions has a detrimental effect upon gas heating in other directions. Already arbitrary bureaucracy has selected the least offender of three possible contributors to insanitary atmospheric conditions in factories and workrooms as the object of bitter aversion. These three sources are bad ventilation, human exhalations, and the flueless gas-stove. But the fact remains that if, in places where human beings meet together for work or other purpose, the ventilation is sufficient to carry off the toxic impurities discharged into the atmosphere by those human beings, there need be little trouble in regard to the pure carbonic acid emitted by the gas-stove. A considerable proportion of such carbonic acid in the air we breathe is harmless; and what is more it is not a stubborn product that refuses to be amenable to the same ventilating provision that is found sufficient for the removal of the respiratory and skin emissions of human beings. It was an excellent principle that Dr. Toogood laid down in his report on the Lewisham experiments, that (in effect) if a place was not ventilated in a manner that would allow of the employment of a gas-radiator, then it was not a fit place for human use. Mr. Glover, during the discussion, pointed to the large amount of carbonic acid there is to be found in mineral water factories; but no harm comes to the employees. Mr. Brearley, in replying to the discussion, cited experiments that go to prove the distinctly differing physiological effects of pure carbonic acid and of carbonic acid charged with organic matter of a noxious character. There must be something definite about the foundation one adopts for preferences in connection with gas heating. Nescience, working outside the gas industry, seems in this matter to have made certain rules; and unluckily it has gone astray, and inflicted an injustice. The position must not be accepted; any acceptance of it may do a vast amount of harm to the industry in the future. Are there those among us who are so short-sighted as not to see in what ways, without specific mention? It is all very well to say that a certain rule has been laid down, and it has to be faced. What has to be faced is the work of showing that the rule is vicious, and that the real evil lies in other directions. To tackle this work, it is necessary for any who may be sitting on the fence, to get off promptly.

The other paper that engaged attention at the meeting was by Mr. F. Paternoster; and in it he described in detail the work involved in reconstructing a retort-house at Felixstowe. For a comparatively small place, the work involved was considerable. The driving of piles to large and varying depths for foundations, and the raising of the roof of the house by several feet, were among the features that showed that engineering ability is as necessary in a moderate sized, as in a large, works. It would have been quite easy, under the adverse conditions with which Mr. Paternoster had to deal, for him to have landed his Company into a relatively heavy expense; but, as it was, he carried the work through to success, and in a very economical manner. Mr. Paternoster is to be President of the Association next year; and there will then be an opportunity of making a closer acquaintance with the work described in the paper.

Light and Illumination.

The science of artificial illumination has, without doubt, been sadly neglected. Attention has been mainly concentrated on the means of providing the light; while the application of the light has been treated in a sort of haphazard fashion. The papers presented at the meeting of the Illuminating Engineering Society yesterday week (as reported elsewhere in this issue) together constitute a plea for an alteration in the conditions so far as illumination itself is concerned. Of course, we cannot expect to arrive at perfection in illumination by attempting to follow any abrupt, revolutionary course. It is true that the Inspectors of Workshops and Factories are urging upon employers the need, in their own interests and of those of their employees, to apply illumination by rule to the conditions of work and general environment. It is true, too, that public authorities, through their departmental servants, are being persuaded to have the illumination of public establishments carried out in a scientific fashion, and not merely on lines that appear to fall in most conveniently with architectural design. These are the paths of least resistance to public culture in the matter of illumination; but that culture will only proceed gradually. Meanwhile, there are those who are identified with the great industries that supply the illuminants; and there is no answer to the charge that, in those industries, knowledge of the proper application of light for obtaining illumination most suitable for condition and purpose, is not so complete as is desirable. While admitting this, it must be said that illumination professors cannot, with any decency, throw stones at the producers of

lighting agents; seeing that we find their knowledge is not yet on such a solid foundation that they are in agreement on many points. This fact, however, is a very good reason for persevering with the study of, and the research into, the subject. Self-culture must precede any attempt whatever to educate others.

Mr. Haydn Harrison, in his paper, argues for the use of a consistent terminology in connection with illumination. This is necessary unless there is to be chaos; and therefore Mr. Harrison—not necessarily as perfect, but as suggestive—has produced a list of generally, and ofttimes indiscriminately, used terms with the meanings he attaches to them. He will be glad to see these discussed by practical men engaged in the work of illumination. Both in Mr. Harrison's paper and in that by Mr. P. J. Waldram, much was said about reflection and the value of reflecting surfaces in giving satisfaction and economy to users of illuminants. It is in this direction of reflection that there is (as the papers show) good scope for much instructive and valuable work to be done. But there, again, public taste will not be governed entirely by scientific rule. Take the comparative reflecting values of different wall papers for example. Householders are not going to submit to the monotony of even approximate uniformity in the character of their wall coverings and decorative schemes for the purpose of seeing the maximum of efficiency in illumination. We are afraid that, generally speaking, they think more about eye effect than the effect that their choice of wall coverings and appointments will have upon the natural and artificial illumination of their rooms. However, the more knowledge that is obtained regarding the subject of illumination, the better able will those be whose business it is to do so to give advice thereupon, and to bring that knowledge to bear whenever opportunity allows.

The Deplorable Tale of Coalite.

The shareholders of the British Coalite Company have met under the chairmanship of Sir William Preece, who is the only original Director who has stood by the sinking ship (which never had any real substance in its structure), and who—Sir William was not a promoter—paid for his holding in hard cash. It is only right that this statement should be made. But it was a wretched story he had to lay before the shareholders. Money has gone in its tens and (it appears) hundreds of thousands; and financially the concern is, it seems to us, hopelessly involved, with the door open wide for the entrance of the receiver. It will be next to a miracle if negotiations can do anything to relieve the present financial situation; it will be next to a miracle if any persons can be found who are prepared to provide further capital for additional experiment. The whole history of the Company proves the concern to be not only a financial but a technical failure; and, moreover, the present optimistic Managing-Director (Mr. Herman Clarke) asserts that the process has limits to its geographical applicability from the commercial point of view.

It has been a strange process, and a strange concern. Never before has there been an undertaking launched in the City that has had more meretricious literature and statement flaunted before the public, and then the shareholders, than has this one. But now that a large view has been allowed behind the scenes, facts and public statements stand out on opposite sides with curiously inharmonious lineaments, and not the least interesting of the contrasts to the gas profession generally will be the statement as to what happened in connection with the plant and its operation at the Plymouth Gas-Works. This plant and the one at Hythe have proved, as we expected they would prove, that there was nothing tangible to be got out of the coalite process by gas undertakings; and now that the British Coalite Company have severed the old technical connections, there is a larger appreciation of the fact by those who are at the head of such affairs as there are left to the concern that the work of the gas industry is daily receding further and further from low-temperature carbonization. The report of the meeting in our news columns will supply sufficient justification for the attitude that has been taken all through in connection with this matter in the "Journal," from which attitude an attempt was once unsuccessfully made to persuade us to depart.

But, in face of all the happenings of the past, we cannot understand what Sir William Preece means when he says "there is nothing wrong with the system, and the patents "are as sound as ever." To those who are technically interested, and who know the general history of coal carbonization for the production of gas and of metallurgical coke, it would be extremely interesting—in view of the organic changes that have been made from time to time in the Coalite plant and system of working—if they could have re-cast for their information the lines of the present claims under the patents, or a reconstructed description as to what is the coalite system to which Sir William Preece refers. So far as we are permitted to view the so-called "system" from the distance, we fail to see the parts with which carbonizers had not acquaintance before coalite came to disturb the composure of those people who have parted with money in the venture. As we were saying last week, no one point of temperature for coal carbonization is of any value upon which to invest a large amonnt of capital; and, if Sir William Preece does not know it, gas manufacturers do, that the temperatures of coal carbonization had a very big range in pre-coalite days. The temperature point has in the coalite experimental work been increased from what it formerly was; and now Mr. Herman Clarke states that at Barking fire-clay retorts have been adopted "of the general "design used by coke-ovens all the world over at the "present time." There is not very precise expression in this reported sentence; but it is plain what the Managing-Director means. In view of this, there is more curiosity than ever to ascertain the amount of substance there is underlying Sir William Preece's statement as to "the "patents being as sound as ever."

Things are as they were as the result of the meeting of the shareholders last Wednesday, excepting that a resolution was passed adjourning the meeting until early in July; and the Directors have also been asked to consider the advisability of winding up the Company in order to avoid further loss. Perhaps before the shareholders have an opportunity of meeting again, they will hear of a man in possession. If this does not happen, it is to be hoped that optimism will not prevail, and further expenditure be incurred on this wild-goose chase. The question is, Can the Coalite Company get more commercially out of a ton of coal than is obtained by the gas producer's method of carbonization? We say they cannot. Mr. Herman Clarke was honest in stating at the meeting, despite his optimism, that technically the system is not out of the wood yet. There is much to be learned and to be done. But the chief thing that is wanted is intelligent management, from which one may draw the conclusion that it is Mr. Herman Clarke's view that "intelligent management" has been an absent characteristic in the past. Let it remain there. Every man is entitled to his own view upon matters on which he is competent to form judgment. Our view is that the process has been at the very bottom of the trouble. Apart from organic difficulties, it was not an economical one. The next step will probably show us whether or not the end is to be deferred.

Oxide Purification Hints.

We are very pleased with the paper that Mr. Ernest Scears, Assistant to Mr. W. E. Price, of Hampton Wick, read before the Southern Junior Association last Friday—not only on account of the description of a good type of modern purifier installation that the communication contains, but on account of the reminder it gives of several useful points concerning the working of purifiers, which are not so frequently adopted as economical working ought to suggest. There will be full sympathy with Mr. Scears' plaint as to the capital cost of, and extent of ground area occupied by, purifiers being seemingly out of all proportion to the amount of sulphur impurity in the crude gas. Yet it is difficult to see how either can be reduced without taking the burden off first cost and putting it upon constantly running working expenses, which would not be prudent. The new plant at Hampton Wick is operated on the reverse action system; and among the methods which is the reverse of customary, though not by any means a new one, is that the gas is led into the top of each box, and the outlet is taken from the bottom. Now when the excellent tabulated results are examined that are given a little later in the paper, there is on very striking thing that gas-works cannot generally claim; and it is no doubt partly—perhaps we might say largely—due to the admission of the gas in the top of the purifiers. It is seen that when the oxide was removed from the boxes *for the first time* the percentage of sulphur (dry basis) in the top tray of No. 1 box was

58, No. 2 box 55, No. 3 box 56, and No. 4 box 58. It is a large experience that will bear out the statement that often purifiers have to be changed three times to reach such percentages as these; if they are reached with two changes, then it is considered that good work has been done. Back-pressure necessitates this more frequent changing through the hardening of the bottom layer of oxide. The gas entering at the bottom has not more than about half the area of oxide over which to spread, on account of the grids, that it has when it enters at the top. The result is that when back-pressure necessitates attention to the bottom layer, the superimposed material has all to be removed, whereas, when the gas enters at the top, and when the uppermost layer hardens, it is an easy matter to loosen or change the top tray. Top entry is therefore economical. Mr. Scears has a tilt at complicated purifier connections that are found on some works; and, verily, there are works where systems of connections and valves are to be found which are only known thoroughly to the works' "oldest inhabitant." It is a suggestion worth noting that, instead of having only one pipe at the top of each purifier for testing purposes, provision should be made for this between each of the trays of the purifiers. The paper supplies a good example of a modern purifier installation and practices that make for economy.

Midland Junior Association and the Joint Meeting.

The Midland Junior Gas Engineering Association (whose title is now, by the way, to be shortened by the omission of the qualifying word "Engineering") last Thursday evening, with their annual general meeting, completed another successful session's work; but there still remains one fixture in which all the members are taking the keenest interest. This is the joint meeting of Junior Associations, which is to be held in Birmingham on Saturday week. A very good programme is being arranged; and those attending are certain to spend an enjoyable and profitable day. Some indication of what visitors will be invited to see has already been given in the "JOURNAL" (p. 16); and opportunity may now be taken to urge all the members of the different Junior Associations who can possibly manage to do so to join the parties that will be journeying to Birmingham in order to meet their brethren of the Midlands. The Junior Association movement is a thriving, and we feel convinced a lasting, one; and these joint meetings afford an excellent opportunity of demonstrating its strength. As to the work of the Midland Junior Association, it will be seen from the report that the membership is now 160; the roll being greater than for any previous session. The five papers which were included in the programme now completed, as well as the Address of the President (Mr. R. S. Ramsden), have all been excellent, and full of matter calculated to be of use to the members. The visits, also, which have been duly chronicled in these pages, were most successful—leaving nothing to be desired in the way of interest. The "Coffee Meetings," which were tried for the first time during the past session, have proved a valuable departure; the informal discussion and social intercourse between the members thus rendered possible being of great advantage all round.

Festival of Empire Exhibition.

Since the article that was published last week on the large lighting and power plant that is being put in at the Crystal Palace by the South Suburban Gas Company, under their contract with the Festival of Empire Exhibition authorities, considerable progress with the work has been effected. The 750-horse power gas-engine, with its electrical equipment, has had a satisfactory run, and a trial trip has been made with the carriages on the "All-Red Route" railway. A large delivery has also been made of the parts for the two 1000-horse power gas-engines. In addition to the high-pressure gas lighting inside the Palace, the high-pressure lamps in the central avenue of the grounds were alight towards the end of the week; and work on the 4500-candle power units on the main terraces and on the smaller units elsewhere in the grounds is making rapid progress. On Saturday evening, high-pressure lamps were running in front of the main entrance of the building on Crystal Palace Parade. They made a fine display along the magnificent parade, and attracted attention far away over the valley that lies on the London side of the hill on which the Palace stands. The South Suburban Gas Company have the upper hand of the big task they have undertaken; and they bid fair to be among the foremost in preparedness for the opening of the exhibition.

Public Safety and Coronation Illuminations.

A short time since allusion was made to the suggestions issued by the London County Council for the purpose of doing all possible to ensure the safety of the public in connection with temporary electrical installations at the time of the Coronation celebrations. The City Corporation are also anxious that regulation to the extent of their powers shall be applied in the public protection. They have laid it down that temporary illuminated signs and devices must not project more than 4 ft. 6 in. from the front of a building, or be at a less distance than 2 ft. from the carriage-way. The height of such projections above the pavement must not be less than 8 ft. All electric circuits and sub-circuits must be provided with fuses of suitable capacity. Bare conductors are barred; and all conductors within reach of the public must be specially protected. Festoons, garlands, and other forms of decorations containing lamps must be properly secured in order to minimize the risk of accident from wind. Another condition is that all shades and decorations of a combustible material in proximity to lamps must be rendered non-inflammable by a process which will withstand the action of rain for several days; and, in addition, no shades or decorations of celluloid or similar substance must be employed. The City Corporation have derived wisdom from experience.

Garcke's "Manual of Electrical Undertakings."

We have received from the Electrical Press, Limited, 37 and 38, Strand, W.C., the above-named work for the current year. It is the fifteenth annual issue; and the fact that it contains nearly 2000 pages, compared with about one-fourth the number in the first volume, published in 1896, furnishes a rough indication of the progress of the electrical industry in the intervening period. In order to keep the book within reasonable limits in regard to bulk, data relating to former years have been condensed; but the information furnished in regard to the past year is as full and as recent as possible. The latest accounts and other financial items are again given in detail; and the engineering and kindred features of each undertaking are adequately summarized. The main portion of the "Directory" section of the book is limited to the officials connected with the electrical industry, with their titles, and a note of their official position and the name of the undertaking with which they are connected. Attached to the general directory of officials is a list of the members of Electric Lighting and Tramway Committees, arranged with the towns in alphabetical order; and the full titles and addresses are given in each case. The financial summaries have many points of interest, particularly in relation to the progress of electricity supply. It is shown that capital invested in this business continues to increase, but not at the rate prevailing before the introduction of metal filament lamps. All the other usual contents of the book—viz., the latest accounts and information for each electrical undertaking, the record of electrical imports and exports, the list of highest and lowest prices of electrical securities, the summaries of Electric Lighting, Tramway, and Light Railway Orders, &c., are again included. The maps in the "Manual" relate to the authorized supply areas of London, the electrical railways of London, about sixty tramway systems and power supply areas, and the underground telegraph lines. The price of the book is 21s. net.

Marriage.—At the Parish Church, Greenwich, the marriage lately took place of Lieut. Gilbert Henry Flavel, R.N.R., eldest surviving son of Alderman Sidney Flavel, of the Flavel Range and Imperial Gas-Stoves, Limited, of Leamington, and Miss Ethel Mary Coursens, of Dartmouth.

A New Book by Mr. Thomas Newbigging.—It is generally acknowledged to be good for a man engaged in an exacting profession to have some kind of recreation to which to turn his attention in the intervals of work. Every member of the gas engineering profession knows that Mr. Thomas Newbigging's recreation is literature. He loves books, and he finds pleasure in making them—never more than when they deal with some part of the kingdom which has special attractions for him. His latest production is entitled "A Nook in Galloway;" and when we say that the "nook" referred to is stated by the author to be dearer to him than any other spot on the earth, it may be concluded that he deals with his subject *con amore*. In a little book of a hundred small pages, which has lately been published at the price of 2s. net by Messrs. J. R. & A. Kirkpatrick, of Gatehouse-of-Fleet, N.B., and of which we have received a copy, Mr. Newbigging discourses on the natural beauties of a district which was the haunt of his boyhood, and the literary and historical associations of which are, he tells us, seldom absent from his mind. He naturally has a strong feeling of affection for it—so strong, indeed, that he pays it a yearly visit. The effect of this is, he says (using the words of Mr. G. W. Curtis), "to give a tone and flavour to the succeeding twelve months, as the lump of ambergris flavours the Sultan's cups of coffee for a year." The interesting text is illustrated by twelve page plates; a general view of Gatehouse-of-Fleet serving as a frontispiece.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 319.)

THE course of movements on the Stock Exchange last week was for the most part unfavourable. The process of "shaking out the weak bulls" was in full swing for the first four days, and the persistent selling dragged down prices. Home Rails were the chief sufferers; but others gave way in sympathy. Happily the movement had run its course by Friday. Then a smart change in direction took place; and a fairly considerable recovery was achieved—Consols closing with only a net loss of $\frac{1}{8}$. At the opening on Monday, the weakness was not apparent, but it developed during the day. Consols shrank $\frac{1}{8}$, Rails were disappointed at some Easter traffics, and Americans were quite flat. Tuesday was dull; but the last prices were not the worst of the day. Consols lost another $\frac{1}{8}$, Railways had a rather large fall, and a failure in the Miscellaneous Market was not cheering. The tone on Wednesday was still weak. Government issues lost strength; Consols falling $\frac{1}{4}$. Railways were still sold down; but Americans were a bit brighter. Thursday saw the fortnightly account settled; and, after some hesitation, the outlook partially improved. Consols began with a rise of $\frac{1}{8}$; and Americans and the Foreign Market were quite steady. Railways were, however, persistently weak. Friday opened rather doubtful, but soon brightened. The selling of Railways ceased, and a smart recovery set in; and Consols had a further rise. Saturday was the most cheerful day of the week. Consols rose $\frac{1}{4}$; and from their advanced position of Friday, Railways pushed up higher. So the markets dispersed for their May Day holiday without misgivings. In the Money Market, there was a considerable demand at advanced rates, and discount was harder; but easier conditions obtained before the close. Business in the Gas Market showed less animation than the average of late; and a large number of issues were entirely neglected. The general firm tendency was maintained, though one or two issues were easier. In Gaslight and Coke, the ordinary was moderately dealt in at the prices which have steadily ruled for many weeks past; all transactions being within the range of 105½-106¼. In the secured issues, the maximum was done at from 85⅛ to 86⅛, the preference at from 102 to 103, and the debenture at 80 and 80⅞. South Metropolitan was unchanged at from 119½ to 120⅜, with one special deal at 119. In Commercials, the 4 per cent. changed hands at 115½, and the debenture at 78¾. Among the Suburban and Provincial group, British was marked at 43¾, Bromley "A" at 116½ free, ditto "B" at 87½, South Suburban at 120½, and Tottenham "A" at 143. On the local Exchanges, Liverpool "A" realized 215, and South Shields 155—a rise of 1. Tynemouth had a rise of 2½. In the Continental companies, Imperial had transactions at from 191 to 192½, ditto debenture at 93⅜, and European at from 19⅛ to 20—a fall of ½. Among undertakings of the remoter world, Cape Town realized 6½, Primitiva from 7⅞ to 8, ditto preference from 5 1/16 to 5⅜, and San Paulo 16¼.

ELECTRICITY SUPPLY MEMORANDA.

The Tomlinson-Lee Statistics Again—A Few Questions for the "Review"—Light on Wimbledon's Own Figures—Street Lighting and Other Points.

WE have long since ceased to be surprised at anything our electrical contemporaries may say on subjects in which gas is concerned; but there must be a little expression of regret that the critical judgment of our dear old friend the "Electrical Review" does not appear to us to be quite up to its former standard. An illustration is to be found in some editorial notes on the public lighting statistics that Mr. Tomlinson-Lee, of Wimbledon, recently published, and upon which we have already had something to say in the "Memoranda" (*ante* pp. 95, 123). Though Mr. Tomlinson-Lee has seen our comments, he has not ventured to reply to them. He has also seen Mr. H. W. Woodall's letter in the "JOURNAL" for April 18 (p. 180). He has not ventured to reply to it. We will now try to stir the "Electrical Review" into action (seeing that it adopts, with implicit confidence, the story of the costs per candle power per annum); and it is hoped there will be better success with it than with Mr. Tomlinson-Lee. It will perhaps facilitate our contemporary's task if a few plain interrogations are put. It seems to be accepted that the whole truth and nothing but the truth appears in the statistics; inasmuch as it is stated that "they amply bear out the confidence with which electrical engineers look forward to an immense increase in electric street lighting in the future." On a point of construction, of course if the electricians are looking "forward," they are naturally looking to "the future." However, the first question is, (1) Are the candle powers quoted for the electric and the gas lamps, from which the costs per candle power are calculated, the results of actual candle-power tests, or are they merely estimated? The answer that our contemporary is able to give to this will make all the difference to the reliance that can be placed upon the relative costs per candle power per annum. The question bears upon Mr. H. W. Woodall's letter (*ante*, p. 180), which categorically impugns the veracity of the figures as applying to Bournemouth. Then, (2) What has the "Electrical Review" to remark in defence of the Bournemouth figures? Mr. Woodall says: "The electric arc lamps alluded to are nominally 1000-candle power each; but actually I should doubt if they yield 500-candle power." If the remainder of the figures are open to this indictment, the basis of our contemporary's glorification of the compilation by Mr. Tomlinson-Lee falls to pieces. The next question is, (3) What does our contemporary think of the offer of the Bournemouth Gas Company to instal 2000-candle power (*photometrically tested*) high-pressure lamps at a cost of £10 17s. 6d. each per annum, in place of the present arc lighting? The high-pressure lamps would work out to 1·3d. per candle power per annum, against the 3·65d. for the "1000-candle power" electric arcs in the town, or rather the 7·3d. per candle per annum, if they are only yielding 500-candle power each. On the 157 arc lamps in the borough, the difference in the expenditure would be £726 2s. 6d. a year, and the difference in illuminating power something immense. Therefore, (4) Does our contemporary think the Bournemouth Corporation will be faithfully performing their duty to the ratepayers if they reject this offer of 2000-candle power (photometrically tested) lamps at such a price?

There are only two places—Wimbledon and Leyton—in the Tomlinson-Lee table where electric lamps alone are used in the streets for which costs are supplied. In the former case, the cost per candle power per annum works out (on the figures given) to 5·08d., and in the latter case to 7·57d. This is a remarkable difference, seeing that the numbers of arc lamps are about the same in both places, and the incandescent electrics at Leyton number upwards of 400 more than at Wimbledon. (5) Will our contemporary be kind enough to explain this difference in cost per candle power? And at the same time perhaps it will consider the authoritative statement of Mr. J. W. Bradley, the City Engineer of Westminster, based on photometric tests, that the cost of gas lighting under the new Westminster contract, in which low-pressure inverted lighting predominates over the high pressure, works out, over three months' tests, to 3·57d. per candle power per annum. This is interesting in view of the opinion of the "Review," that "if the inclusive cost of high-pressure gas-lighting can be brought down to about half that of low-pressure lighting, it will be at a disadvantage in competition with modern electric street lighting." That suggests the next question, (6) State the grounds of authority for this declaration? A question that has a most important bearing (but our contemporary has overlooked it) on that of cost per candle power per annum is this: (7) What are the relative numbers of hours per annum that the gas-lamps and the electric lamps are used in the towns included in the table? The compiler has omitted to mention them; as he has likewise (8) the price per unit charged for the electricity consumed in the public lamps. The next question is, (9) Does the "Electrical Review" consider it is fair to compare the costs per candle-power per annum of electric arcs with small unit low-pressure gas-lamps? (10) Will our contemporary consider the question as to the relative cost per mile of roadway lighted, and state the result? (11) Why is it that the lighting rate per pound per annum is lower in those places where gas only is used in the public streets? It is a pity not to make the list of questions up to a round dozen. So here is No. 12. Can our contemporary tell us the cost at which the Mitcham and Wimbledon Gas Company could now light the streets of Wimbledon using the inverted gas-burner, with its lower gas consumption and its lower mantle renewal, than for the upright incandescent burner of a time ago? We think these questions should supply the foundation for an excellent article on the part of the "Review," either in its best heavy style or in its most caustic form. It is the latter, with its manifestations of hard labour, that gives most delight. We await the replies to our questions with calm and felicitous expectancy.

On further thought, perhaps it is hardly fair to put the twelfth question to the "Review;" and, with the magnanimity which our electrical press friends ever acknowledge that we deal with them, some information may now be presented to them and to others interested bearing on the subject. We have been looking up files of the local papers for the last twelve months or so; and it is found that on various occasions it has been mentioned that the Mitcham and Wimbledon Gas Company, with the assistance of the modern methods of lighting by high and low pressure gas-burners, have been, and are, quite prepared to light the borough for something like £3000 less than the streets are now being illuminated with electricity—that is to say, to be precise, for £3900, which figure includes 1500 and 1000 candle power Keith high-pressure inverted gas-lamps in the main streets to take the place of the present arc lamps, with low-pressure inverted lamps in other roads of the borough. What have the "Review" and Mr. Tomlinson-Lee to say to this figure, in view of the data for Wimbledon that appear in the table compiled by the Electrical Engineer of the borough. In the table, it is stated that the approximate lighting rate at Wimbledon per pound per annum is 3·78d. Alderman Hamshaw last October, in the Council Chamber, stated that the street lighting cost 4½d. in the pound (not 3·78d.); and this 4½d. represents (on the assessment of £420,818) £7000 per annum. That is what Wimbledon has to actually pay for its street lighting; and the Gas Company are willing to do the work with greater efficiency in illumination and in every other way than the Electrical Department for four-sevenths of the sum. Modern progress has now made gas lighting cheaper than ever. It will be extremely interesting to learn what Mr. Tomlinson-Lee and the "Review" have to say in defence of the figures. There seems, too, little chance of the electricity undertaking doing the lighting

for less, because Mr. Dudley Stuart, the Chairman of the Electricity Committee, last July said: "The undertaking only charged the ratepayers the actual cost per lamp;" and yet Wimbledon ratepayers are paying to-day £7000 for their street lighting, while they might have something like double the illuminating power in the streets for £3000 less per annum! Think of it, £3000 saving year after year!

Speaking of illuminating power reminds us of other of the Wimbledon figures. The Tomlinson-Lee table states that 45⅝ miles of streets are lighted by electricity; 91 arc lamps and 1136 electric incandescents being used. The total candle power is said to be 313,500, and the total average per mile 6839. Now only about 5½ miles of the 45⅝ miles are lighted by flame arc lamps—called 3000-candle power lamps. It is a funny little way electricians have of giving nominal distinctions to their lamps which they would not be prepared to swear they deserve. Then there are about 2½ miles of streets lighted by metallic filament lamps, for each of which 200-candle power is claimed. The remaining 38 miles or so of the streets of the borough are lighted by nominal 50 and 32 candle power lamps. There being 48 of the 200-candle power lamps, this leaves 1088 lamps for the 38 miles, or an average of 28·63 lamps per mile. If all these were of 50-candle power, the 38 miles of streets would only have in them an average per mile of rather more than 1400-candle power, which is something different from the claim of Mr. Tomlinson-Lee of an average of 6839-candle power obtained by throwing into the scale the weight of an absurdly high candle power for the arc lamps. If we take it that the 50 and 32 candle power incandescent electric lamps represent 54,000-candle power, and the 200-candle power lamps 9500-candle power, Mr. Tomlinson-Lee has, on his own figures, concentrated 250,000-candle power in 5½ miles of roadway. It seems an absurd difference between nearly 50,000 candles per mile and 1400! This is all highly interesting in view of his claim of 5·08d. per candle power per annum. If Mr. Tomlinson-Lee will separate out his charges, and tell us the total cost per lamp for the arc lighting, the total cost per lamp for the 200-candle power incandescents, and the total cost per lamp for the 50 and 32 candle power incandescents, then we will tell him the cost per candle power per annum in 38 miles of his district. It will not be 5·08d. Among other points we have ascertained from our search through the local papers that one-half of the arc lamps along the main road are turned out at midnight. That, too, is an interesting fact not known by many outside Wimbledon. We also find a petty dog-in-the-manger spirit exists among certain members of the Corporation. The Gas Company asked early in June last for permission to erect a high-power gas-lamp on the kerb outside their new office in Wimbledon. Permission was refused. Why? Are the Council so afraid of modern gas lighting? Are they so afraid of giving their competitor one little opportunity? The Gas Company only wanted one lamp in the streets. The Corporation Electricity Department—a trading concern like the Gas Company—have 1227! Narrow-mindedness of the kind does not look well in a local body such as that at Wimbledon. But if the lamp has not its feet on the kerb of Hill Road, Wimbledon, it is nevertheless in front of the new office doing duty to-day, and report says that it is not doing anything towards ratifying the claims of electricity to be the light *par excellence*. Another merit of the light is that it does not fail. The people of Wimbledon have on more than one occasion experienced the unhappy and incurable failing of electric lighting.

There was an interesting discussion on the paper by Mr. W. B. Woodhouse to which reference was made last week, in which paper the author advocated the use of overhead wires for electricity distribution in country districts. There are two or three remarks in the reported discussion that especially attract notice. Mr. E. A. Barker comes from Barnsley; and at Barnsley the street-lighting question has been carried to a very acute stage. Mr. Barker told those present at the meeting [this was the Yorkshire Local Section of the Institution of Electrical Engineers] that several photometric tests had been made between the last Corporation street lamp and the first incandescent lamp in Dodworth, with the result that it was found that the "balancing point" of the light was on each test at a point 39 yards from the gas-lamp and 51 yards from the electric, showing a penetrative power, in favour of the electric lamp, of 25 per cent. As we read this, the questions arise, as to who made these tests, what photometer was employed, was the gas-lamp fitted with a modern street inverted burner, and was the electric lamp of the modern metallic filament type? The reason these questions crop up is that, when official tests of metallic filament lamps and of inverted gas-lamps were made in Gower Street by independent testers for the Borough Council of Holborn, metallic filament lamps giving a (photometrically tested) light nearly 100-candle power greater at the source than the inverted gas-lamps that the Gaslight and Coke Company put up, the latter were found to furnish a superior illumination along the roadway between the lamps, which showed that their penetrative power was greater. Had gas-lamps of the same candle power as the electric ones been put in, the illumination along the roadway would have been still further enhanced. Another point. Mr. Woodhouse stated the cost of street lighting at £2 per 81-candle power electric lamp per annum (2000 hours.) Mr. Thursfield declared that at Chester, they had a large number of these lamps—in fact, nearly every street gas-lamp was converted; but he could not possibly get the running cost below £3 per annum. He also reminded Mr. Woodhouse that to count only 2000 lighting hours a year was very low. The author of the paper had also referred to cottagers who had used 160 units of electricity per annum with carbon filament lamps. One speaker thought it would be cheaper for a cottager to move than to pay such a bill for the light he obtained.

PERSONAL.

In "Register of Patents" in the "JOURNAL" for the 18th ult., an abstract was given of the specification of a patent taken out by Mr. WILLIAM GADD, for improvements in connection with the system of spirally-guided gasholders with which his name is associated. Mr. Gadd's many friends in the gas industry will be pleased to learn that he is in good health, and that he and Mrs. Gadd are looking forward to the celebration on Monday next of their "golden wedding."

Mr. ERNEST SAINTER, of Longwood (formerly of Batley), has been appointed Manager of the Houghton-le-Spring Gas-Works. Mr. Sainter was educated at the Batley Grammar School. Nine years ago he was articled to Mr. J. H. Brearley, the Engineer to the Longwood Gas Company, to whom he has acted as an assistant for the last four years. He is the holder of first-class certificates in the Honours grade in the City and Guilds of London Institute examinations in "Gas Engineering" and "Gas Supply," as well as diplomas in other scientific subjects. Mr. Sainter commenced his duties yesterday.

Mr. LEWIS MITCHELL, A.M.Inst.C.E., Water-Works Engineer to the Corporation of Bolton, has been appointed Water Engineer to the Corporation of Aberdeen—a new office which has been created in connection with the movement that has been in evidence for a number of years for an augmentation of the city water supply. Mr. Mitchell was educated in the Anderson College, of Glasgow, and was afterwards assistant in the water departments in Greenock and Edinburgh, subsequent to which he was Resident Engineer to the Bury and District Joint Water Board. In 1905, he became chief assistant to the Bolton Water-Works Engineer; and in 1908 he was promoted to his present position.

Mr. FREDERICK N. SKINNER, a member of the works staff of the Wallasey Corporation Gas and Water Department, who has obtained the position of Works Assistant to the City of Waterford Gas Company, was recently the recipient of a case of mathematical instruments and a shaving outfit at the hands of the office and works staffs. Mr. G. E. Ashurst (Chief Clerk), who made the presentation, in the absence of Mr. J. H. Crowther (Engineer and General Manager), wished Mr. Skinner health and strength to carry out his new duties, and also a prosperous career. Mr. Skinner expressed his sincere thanks for the kind remarks made and for the useful gifts he had received, and said they would always remind him of the many friends he had, and also of the happy days he had spent in the service of the Wallasey Corporation. Mr. Skinner served his apprenticeship at the Wallasey Gas-Works, and is a holder of the City and Guilds of London Institute's Honours certificates in "Gas Engineering" and "Gas Supply," as well as in other technical subjects.

OBITUARY.

Mr. C. R. CLEMENT, who died at Wantage last Wednesday week at the age of 75, was Chairman of the Wantage Gas-Works Committee.

The "Journal für Gasbeleuchtung" reports that the death occurred, on the 9th ult., of Herr D. SCHNEIDER, the Manager for many years of the Cottbus Corporation Gas-Works. Deceased had been an active member since 1891 of the German Association of Gas and Water Engineers, having in particular assisted in the foundation and management of the Benevolent Fund.

Bailie ROBERT MUIR, Convener of the Gas Committee of the Kilmarnock Corporation, died somewhat suddenly at his residence in Kilmarnock on the 22nd ult. As stated in the "Scotch Notes" in to-day's "JOURNAL," Bailie Muir was present on the previous evening at a presentation to Mr. W. Fairweather, the Gas Engineer and Manager, and took part in the proceedings. He was 71 years of age. He had been for 18 years in the Town Council, and during the time he held the post of Gas Convener he promoted with all his power the policy of transferring the gas-works to the new site at the river side.

North of England Gas Managers' Association.—The sixty-eighth half-yearly meeting of the Association will be held at the Institute of Mining and Mechanical Engineers, Newcastle-on-Tyne, next Saturday, under the presidency of Mr. John Lewis, the Distributing Engineer of the Newcastle-on-Tyne and Gateshead Gas Company. According to the programme issued by the Hon. Secretary (Mr. Herbert Lees, of Hexham), the technical business will consist of a paper on "High and Low Pressure Distribution Schemes at Tynemouth," by Mr. F. C. Willis, and a lecture on "Teclu's Method of Ascertaining the Heating and Illuminating Power of Coal Gas," by Professor P. Phillips Bedson, M.A., D.Sc. The remaining business will include the presentation of the statement of accounts and the election of officers for the ensuing session.

GAS PUBLICITY WORK.

[COMMUNICATED.]

AT last gas companies have realized that, by means of "Publicity," much more could be done to increase their sales than they have hitherto thought possible.

The Committee appointed to exploit the scheme have issued a comprehensive "Memorandum" [see *ante*, p. 161], which explains fully what they desire to accomplish; and this will, I have no doubt whatever, be exhaustively considered and discussed by those interested. I have read and considered it well; and while I agree with all that is put forward, I do not think that both sides of the question have been adequately dealt with.

From the point of view of "Publicity," the scheme is admirable; but what I notice is the absence of details as to how gas companies are to deal with the increase of sales which is to be brought about by the scheme. I do not mean the increase in consumption of gas; for I fully realize that gas managers can well be left to deal with this. I mean, How will they deal with the inquiries as to the result of "Publicity?"

Unless they have a properly organized department, I can foresee trouble and disappointment, both to the inquirers as well as to the company, before any real commercial expansion can be obtained as a result of systematic, persistent, and forceful advertising. Gas companies must realize that their sales and other departments require to be remodelled to suit the new conditions.

To produce efficient and economical working, systems must be devised which will reduce details to a minimum; the area supplied by the company must be divided and subdivided into districts; in each district reliable statistics must be tabulated of what are the existing conditions of the service; then what the possibilities of expansion are likely to be; and, finally, how this expansion is to be dealt with.

How this is to be worked out is beyond the scope of this article; but it will be obvious that whatever the system is which is finally adopted, unless the effort is properly directed by a man experienced in this particular department, success is impossible.

That the present system is considered to be imperfect is evident from the unanimous support the scheme received during its discussion. But that gas companies, as a whole, realize what is required from themselves to make the scheme successful, is altogether problematical.

I do not wish to infer that some gas companies have not already realized this; for their sales and other departments prove otherwise. But I am confident the majority simply think their sales will automatically increase as a result of the energies of the Committee, without any exertion or preparation on their part.

The benefits each individual company will obtain as a result of combination in the matter of advertising, printing, articles, &c., are obvious. But what I consider has yet to be made clear is the fact that each company must be so equipped as to appropriate to itself every particle of benefit that "Publicity" will provide.

I do not wish the Committee to feel that I am unduly criticizing their scheme. I have already said that I consider it is admirable. But I do think they will agree that the point to which I have endeavoured to give prominence is one that should receive their careful consideration, and is also one which must be fully explained to gas companies if their scheme is to meet with the measure of success that it certainly deserves.

THE ENGINEER AND THE NEW BUSINESS MAN.

[COMMUNICATED BY AN AMERICAN CORRESPONDENT.]

"IT is plainly evident," says the New Business Man, "that this is an Engineer's article; for who else in 1911 is not ready to acknowledge that the New Business Man is more essential to the gas industry than the Engineer, and therefore should be named first." That this lesser importance of the Engineer, and therefore his subordination to the New Business Man, is a fundamental doctrine in the latter's creed, is shown by a perusal of the paper on "Service," by C. W. Hare, read before the National Commercial Gas Association last December. Mr. Hare, as Manager of the New Business Department of the United Gas Improvement Company, controls the new business policies of more gas companies than does any other one man in this country. For this reason alone, aside from the rather new point of view—new certainly to engineers here—it will be of interest to consider Mr. Hare's statements.

He believes, rightly, that perfect service to the consumer should be the aim of every company, and therefore of each of its employees. He seems, however, to identify perfect service with a satisfied consumer. This implies too high an estimate of average human nature. The only result of satisfying every consumer will be a loss of money to the company, or a higher charge to the reasonable consumer to meet the expense entailed by the unreasonable one. In this country, one of the activities of the new business departments has been the sale of mantles and other lighting appliance parts. Many of these sales are charged; and it is when payment is demanded that the unreasonable consumer is seen at his best (or worst). Excuse after excuse for non-payment is offered—all based on various alleged defects in the work done or the articles sold. Perfect service in these cases involves not satisfying the consumer, but insisting courteously, yet firmly, on payment.

Mr. Hare's recipe for the better obtainment of perfect service is "by selecting one man, and placing him in general charge of all employees whose work brings them in direct contact with the public. . . . In my opinion, this man should be the commercial (new business) man, because I think it is evident that the *very nature of his work makes him more vitally interested in giving good service than is the engineer.*"

As an engineer, I would like to take issue with Mr. Hare on the statement that I have italicized. Mr. Hare desires to change an organization composed of three departments—viz., a new business department with canvassers and salesmen; a commercial department with order clerks, meter readers, and collectors; and a distribution department with workmen of various kinds. The respective heads of these three departments report to the general manager of the company; and their employees are in direct contact with the public. Mr. Hare believes the head of the new business department, or new business manager, should be given direct supervision over the commercial agent and the distributing engineer, for the reason italicized above. He has apparently lost sight of the great change that, with the new century, has been effected in the ranks of gas engineers. The distributing engineer of any company, whose management has realized the value of and established a new business department, is a young man with a college education, who has "dreamed dreams," and is as fully steeped in "altruism," and also "enlightened self-interest," as the new business manager. He has welcomed with delight the change in policy which recognizes that skimping in main extensions and distribution expense is not "good business." His desire to do every job as cheaply as possible is not at all incompatible with really good service. His position is entirely similar to the civil engineer who designs a bridge both inexpensive and efficient; to the railroad engineer who locates his track to secure economy in construction cost and in operating expense. He would fall very short of the engineering ideal indeed were he, as Mr. Hare fears, to lose sight of the efficiency of his work—viz., good service—in his desire to keep down costs. It is natural enough for Mr. Hare, like any other man interested in his work, to exalt its relative importance, and to ask for authority over co-ordinate branches on the plea that this means better service. It is a little curious, however, that Mr. Hare should have overlooked a striking instance, and in his own city of Philadelphia, too, where the engineer has succeeded in combining efficiency with good service. When the city gas-works were first leased by the United Gas Improvement Company in 1898, the two departments that met the public—viz., the commercial and the distribution departments, for there was no new business organization until 1908—were told that good service was indispensable. Economy was desired, but must be held secondary to efficiency. In 1905, certain events afforded a test of how well the wishes of the management had been carried out. Bitter criticism of the Company was aroused over certain financial details, but such criticism was coupled with a frank admission of its admirable service to its consumers. So the engineer was proved competent to work for some other ideal than mere cost.

My contention, therefore, is that the engineer is to be relied on in maintaining a proper attitude towards the consumer. The problem is not, as Mr. Hare seems to believe, to bring about the right attitude on the part of the head of the distributing or any other department, but on the part of every employee. Success in this will depend on the qualities of each department head as a leader of men. There are not lacking instances of new business managers anxious to give good service, but whose canvassers, by overrating their wares, or by selling the wrong article, fall quite short of the ideal set before them. To make the selling force as efficient as possible is the problem of the new business manager; and, in the same way, to ensure a first-class job by each workman is the task before the distributing engineer. A wise general manager will work these two departments side by side, pitting one against the other, and will not, by placing control in the hands of the new business department, lose the healthy benefit to be derived from competition, as well as the check that, as a co-ordinate branch, the distribution department could afford against excessive operating expense, caused by unwise new business methods.

As I have said before, this is an Engineer's view. The "New Business Man" believes that the (gas) earth is his and the fulness thereof, and is bending every nerve to convince other people, and especially the owners of gas properties. The National Commercial Gas Association has all the lustiness of a newborn child, and is working hard to attain a prestige equal to that which attaches to the American Gas Institute, as the successor to the old engineering associations. If it succeeds, it will be because, through the devotion of its members, it has been enabled to produce work of greater worth to the gas industry than has the Institute. Should this come to pass, the engineer will have no one but himself to blame for his relegation to second place, with the loss of relative position and of salary that this will entail. In the meantime, the race is still on.

A large number of friends assembled at St. Matthias' Church, Richmond, on the 22nd ult., on the occasion of the marriage of Mr. Calvert H. E. Smith and Miss Bessie Peirce, fifth daughter of Mr. W. G. Peirce, the Water-Works Engineer to the Richmond Corporation.

THE INSTALLATIONS OF GLOVER-WEST VERTICAL RETORTS AT THE ROCHDALE, HELENSBURGH, AND LURGAN GAS-WORKS.

THE construction of the new vertical retort-houses at the gas-works of the Rochdale Corporation, the Helensburgh Corporation, and the Lurgan Gaslight and Chemical Company, Limited, is now so well advanced that it is anticipated that all these plants will shortly be in operation. As considerable interest has been shown by a number of those interested in the continuous system of coal carbonization, we take the opportunity of illustrating (by photographs) the installations at Rochdale, Helensburgh, and Lurgan, at their present stage of completion, and append a brief description of the plants—each of which has some special features to suit the local conditions of working.

At the Rochdale Gas-Works, the new retort-house is built on the site of part of an existing coal-store, adjoining a horizontal retort-house. The building is of steel construction with brick-panelling, and contains five settings of Glover-West vertical retorts, each setting having eight retorts arranged in units of four retorts. The total capacity of the plant will approximately be one-and-a-quarter million cubic feet of gas per day.

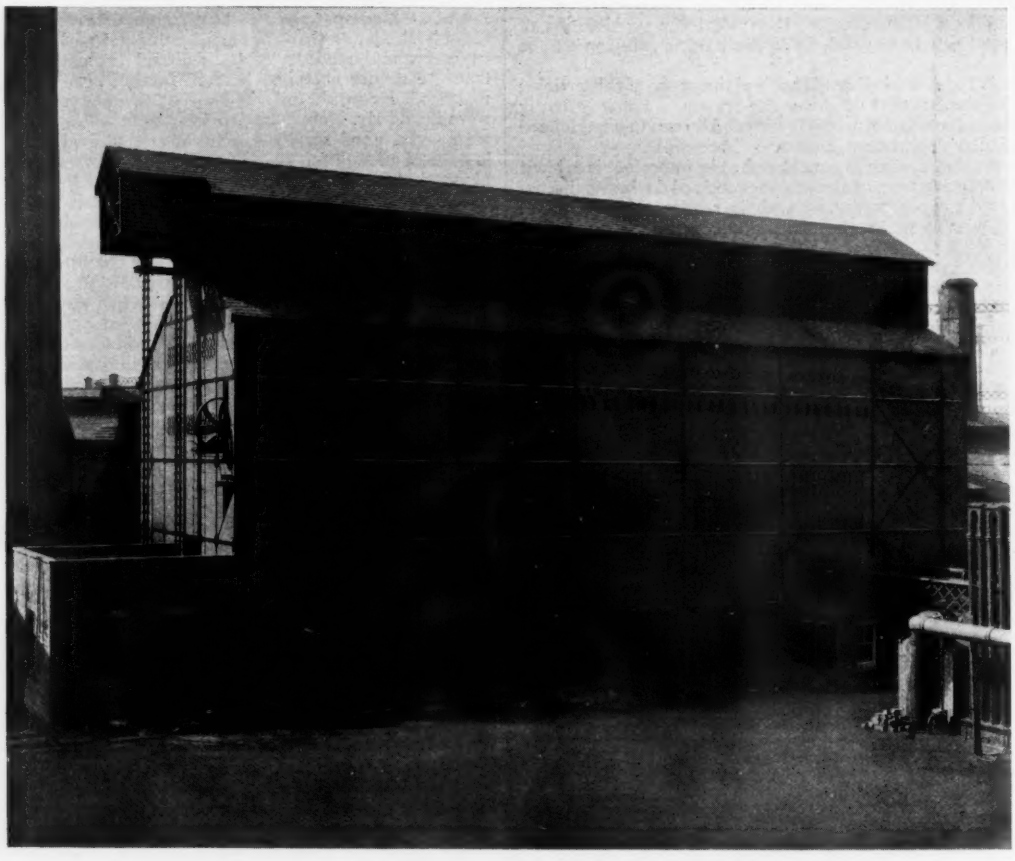
The installation also comprises a coal-handling plant, which receives its supply of coal from a store constructed of reinforced concrete. There is also a coke-handling plant which conveys the coke from the retorts to the yard; and as the coke is discharged from the retorts in a cool state (peculiar to the Glover-West system), the conveyors will not have to deal with hot coke.

As will be noticed from the photograph, the erection is in an advanced state. The retort-bench and equipment are practically complete; and, with the exception of the gravity buckets for the coal-conveyor and a few other parts which require fixing, the plant is practically ready for being put into operation.

At the Helensburgh Gas-Works, the plant, which will have a capacity of approximately half-a-million cubic feet of gas per day, consists of a retort-house containing two settings of eight retorts arranged in units of two retorts to comply with the minimum daily production. The installation will be complete, with coal-store and coal-handling plant, including a railway waggon-tipping gear.

The installation at the Lurgan Gas-Works, which will be capable of producing approximately a quarter-of-a-million cubic feet of gas per day, consists of a steel retort-house with brick-panelling, containing one setting of eight retorts arranged in units of one retort to meet the minimum daily output. It will be complete, with coal-handling plant, with a hoist for raising the coal from the ground level to the coal-bunker above the retort-bench.

It is interesting to learn that the second installation at St. Helens, comprising forty retorts, is also in a very advanced state, and will be put into operation in the course of the next few weeks.

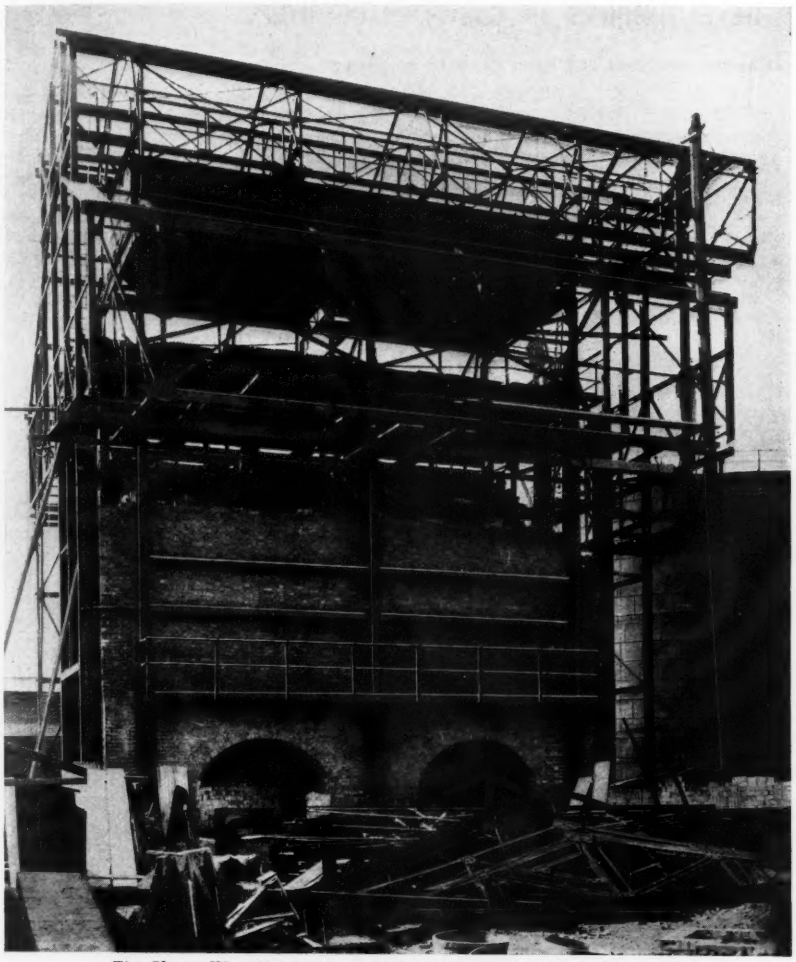


The Glover-West Vertical Retort Plant at the Rochdale Gas-Works.

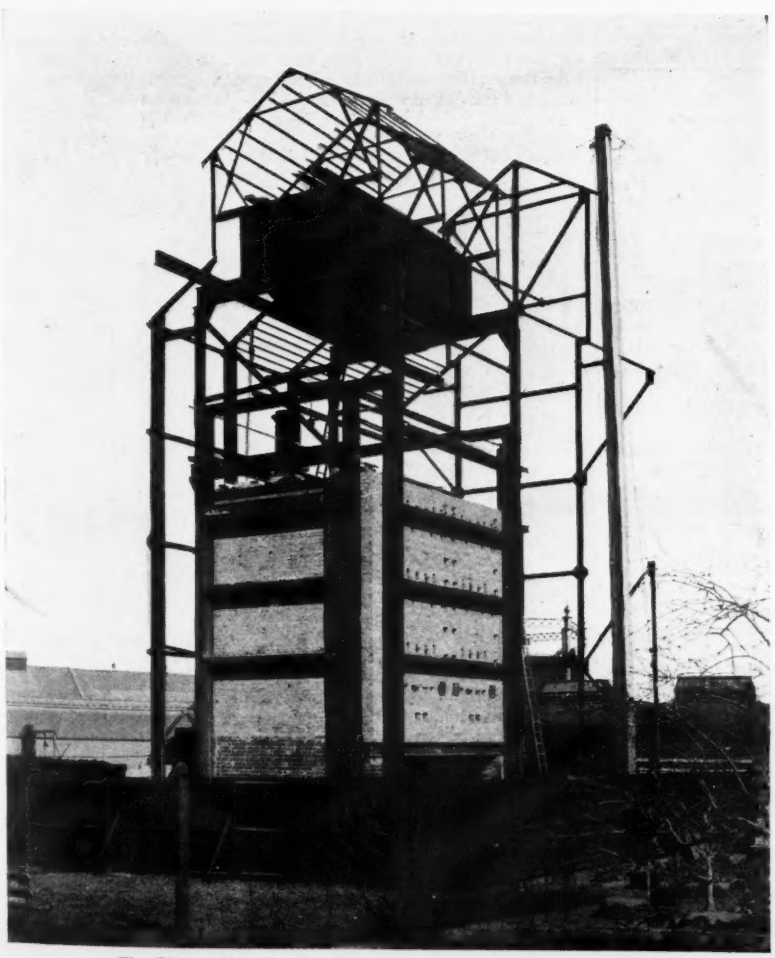
BUILDING TRADES EXHIBITION

At Olympia.

THERE is now being held (and it will remain open till the end of this week) the ninth of a biennial series of exhibitions devoted to the building trades; and the whole of the large space available at Olympia is crowded with goods, included more or less closely within this category, to which manufacturers are desirous of calling attention. Coming, as they do, only at intervals of two years (and there being so many other trade shows of different kinds in between), it is hard to remember exactly the scope and extent of previous exhibitions of this particular series; but it is stated by Mr. H. Greville Montgomery, in a preface to the official catalogue, that the present display, "in the variety of goods exhibited and the elaborate character of the stands erected, far excels any of its predecessors." The catalogue, by the way, is of itself a "big affair;" and one would like it better were it not quite so heavy. To carry open in the hand a book weighing about 2¼ lbs. for the couple of hours or so which it is necessary to spend in walking up and down the numerous passage-ways, if none of the stands are to be missed, is somewhat of an undertaking. But, then, the very size of the catalogue is a proof that there is much to see; and those who use it will be struck by the ease with which it can be employed as a guide, owing to the simple manner in which the stands are numbered and arranged. Another good feature of the catalogue is that at the end the exhibits are classified; and some idea of the scope of the display will be gathered from the remark that this classification necessitates the employment of upwards of 150 headings. On the ground of the hall, there are practically 250 firms represented; while the "Surveyor" section in the gallery includes some 80 more exhibitors. It must, however, be said that among all these there are not a great number whose goods call for special mention here. Speaking generally, it is noticed that of apparatus and materials bearing on the use of tar for road-making purposes, there is a first-rate assortment, which testifies to the amount of attention being given to this matter; while, in another direction,



The Glover-West Vertical Retort Plant at the Helensburgh Gas-Works.



The Glover-West Vertical Retort Plant at the Lurgan Gas-Works.

there are, as is usual on such occasions, several forms of air-gas plants on view.

The only stand which is devoted solely to appliances for the utilization of coal gas is that of Messrs. A. E. Podmore and Co., which will be found in the gallery. Here there is to be seen a representative display of the firm's latest lamps and fittings, many of the former connected up so as to show the excellent and steady lighting effect which they render possible with the use of low-pressure gas and inverted burners. These lamps can be obtained in different styles and sizes, for both interior and outdoor purposes; and in the multiple-burner types, the separate control of each burner is a matter which is frequently of importance from the point of view of economy. The conversion sets for inverted street lighting, whereby old lamps can be cheaply and easily turned into new and up-to-date ones, should not be overlooked; and it may be noted that these can be had fitted with either round or square reflectors. Then there is to be seen attached to one of the firm's lamps Mr. A. E. Broadberry's pressure apparatus for lighting and extinguishing. Other of the overhead lights are provided with the "Telephos" switch arrangement, to which attention was recently drawn in these pages. Among the interior lights, special mention may perhaps be made of the improved "Coronation" pattern, made for one, two, or three burners. The exhibition is one largely of interest to municipal bodies; and therefore Messrs. Podmore make a particular feature of their well-known dust-proof lamps—suitable for retort-houses, dust-destructor houses, coal-shoots, workshops, and other places where dust is likely to be prevalent.

In the body of the hall, Mr. Thomas Potterton, of Balham, shows his "Victor" gas-boilers, "Queen" combined gas and coal ranges, thermostats, and other appliances for use in connection with cooking and water heating. A new model of the "Victor" boiler has been designed for use where only a narrow space is available; but, at the same time, it is pointed out that the original pattern was made of the horizontal type for the purpose of securing the greatest possible efficiency. There is a range designed for the County Council dwellings, the same as the well-known "Queen," but without any provision for hot water. With a thermostatic control fitted to the "Victor" boiler, of course, a regular and constant action is secured; while a patent cut-out valve system provides for the heating, when necessary, of only one-half the contents of the cylinder, with a proportionately smaller consumption of gas.

Among other exhibits, Messrs. Richard Hornsby and Sons have in operation working on suction gas a "Hornsby-Stockport" gas-engine; and the stand is lighted on Thorp and Marsh's high-pressure gas system. Geysers, and other water-heating apparatus, are exhibited by Messrs. Fenlon and Son. An installation of eight Keith high-pressure gas-lamps is utilized to light the space occupied by Messrs. Davis, Bennett, and Co.; and the "Hella Bushlight" can be inspected at the stand of the Webb Lamp Company, who also exhibit the Webb patent self-intensifying gas-burner and lamp standards for sewer ventilation. The Aërograph Company's spray painting apparatus is on view; as is also the Hurry Water-Heater Company's gas heater, more especially intended for fixing over baths where a cheap and efficient hot water supply is wanted. At the stand of Messrs. James Stott and Co. are gas governors and fittings; and at that of the Expanded Metal Company, samples of their speciality. Messrs. George Waller and Son exhibit the "Pinkney" gas-engine; and Messrs. J. Blakeborough and Sons and Messrs. Ham, Baker, and Co., numerous gas and water works appliances.

SOME RECENT DEVELOPMENTS IN GAS-FURNACE WORK.

What the Richmond Gas Stove and Meter Company are Doing.

GAS-HEATED furnaces for industrial and laboratory purposes and their various applications are now claiming the special interest of gas engineers and the departments of gas undertakings entrusted with the development of gas sales. In recent years this subject has taken its allotted place, and has become of considerable importance to several of the gas undertakings in the manufacturing districts, who recognize this new branch of the industry as an active source of revenue. In a great many towns gas-furnaces are being employed for a multiplicity of purposes; and therefore a few particulars of what is being done in this direction by the Richmond Gas Stove and Meter Company, Limited, will be of general interest, using as the basis of this article the developments as illustrated by new furnaces lately supplied by them to a number of the leading steel works in Sheffield and other large manufacturing concerns throughout this country and abroad.

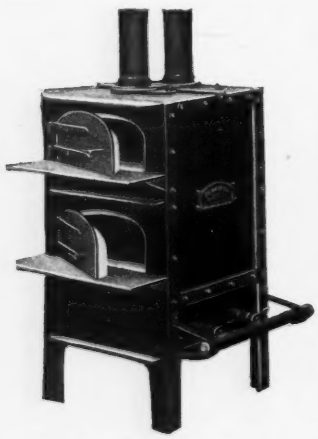
Not forgetting that gas as a fuel is often dearer, though a necessary commodity for many heat treatments, the Richmond Company have made a definite point of the economy in gas consumption realizable by their patent gas and hot-air principle, which has enabled them to successfully compete with coal-heated annealing furnaces. Several of the larger type of these gas-heated furnaces have annealing chambers upwards of 15 feet long, 4 feet wide, and 2 feet high, and are now being used for annealing high speed carbon steel in bar. The illustration shows a furnace of this description, having an annealing chamber 15 ft. 9 in. deep, 2 feet wide, 1 foot high. It has been in operation for about six months, and is pronounced to be a considerable improvement over the old method of placing the steel bars in iron boxes and annealing in the usual coal-heated oven furnace, which is invariably uneven in temperature, and not easy to regulate.

An important point to the manufacturer is that of cost. In this case, the cost with gas-firing has been found to be less than half that of coal, and has the great advantage of not requiring to be used continuously. About 10 to 12 tons per week are dealt with; and we give the actual fuel costs of the furnace per ton of steel annealed, taking the average of the last three months, as follows:

Description of Charge.	Weight of Charge.	Cost of Gas per 1000 Cub. Ft.	Cost in Fuel per Ton of Steel Annealed.	Average Time taken During Heating Process, excluding Cooling.
High-speed steel in bar	1 ton	1s. 3d.	4s. 6d.	5 hours
Carbon steel in bar	2½ tons	1s. 3d.	3s. od.	4 hours

Oxidation is entirely absent on the bars packed in the inside of the charge; while there is no appreciable oxidizing on the outer bars. The results have been considered a commercial success by the user.

The evenness of heat obtainable is, of course, a matter of great importance; and in these days of special steels (many of which cost as much as 2s. 6d. per pound), it is no wonder that gas-furnaces are sought after, inasmuch as they enable the operator to obtain complete control of the various degrees of heat required. With certain manipulations, the furnaces give a *quasi*-reducing atmosphere of heat, which is sometimes desired for annealing non-ferrous metals.

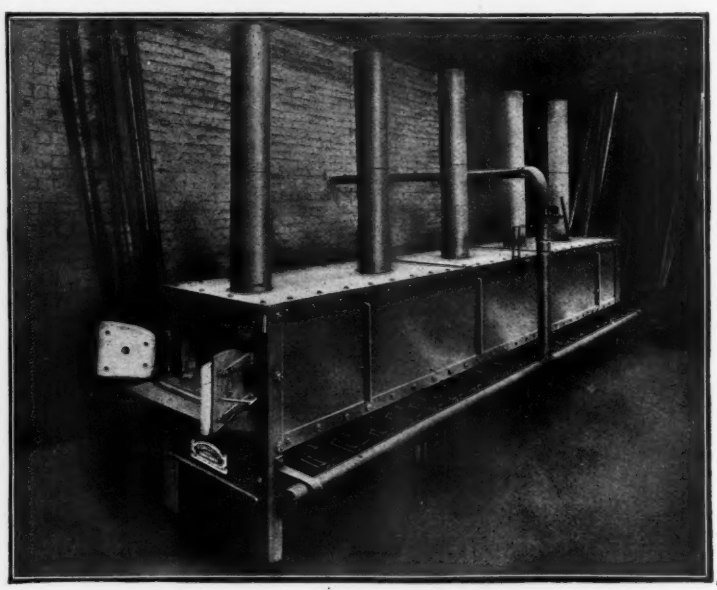


Twin Annealing Oven Furnace.

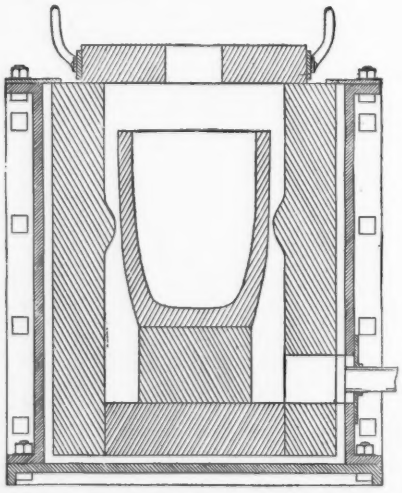
In one important silver and electro plate works in particular, several large Richmond patent gas-anneaaling twin-oven furnaces are at work, having entirely displaced the earlier coal-heated furnaces. In this instance — in fact, the same applies to all firms using the furnaces — the economy and efficiency in the annealing department since the advent of the gas-furnace are named in the highest terms. Temperatures obtainable in this type of oven furnace are sufficiently high for all classes of case-hardening, and quite a large number have been supplied for this particular purpose. Hitherto, blast-oven furnaces have always been recommended, and specially by American furnace makers, who, we learn, have created a large business in the States by extensive advertising and enterprise.

Without going into minute details, it is seen that the firm are building all types of gas-heated furnaces; and as further demonstrating the variety, it may be said that they have lately supplied their patent assaying muffles and small crucible furnaces to many of the leading technical and science colleges in the kingdom; among the number being a large installation of a newly designed muffle embodying the features of the earlier muffles, but with further improvement for laboratory work. It is also seen that they have made a speciality of gold and silver refining furnaces, which are now being exclusively used by several of the largest refineries in the country, and by one of the Continental mints.

One of the most prominent lines of development in the gas industry is in the distribution of high-pressure gas, or its supply by independent plants; and in this connection the firm are minded to be up with the times and requirements. To this end, they make furnaces to work with high-pressure gas; and, as a matter of fact, the system can be applied, when required, to all their furnaces designed for gas and air blast.



Gas-Heated Furnace, with 15-Feet Annealing Chamber.



Crucible Furnace for High-Pressure Gas; also for Gas and Air Blast.

We give an illustration of a crucible furnace which may be worked with either high-pressure gas or gas with air under pressure. The temperatures obtained have been sufficient to melt steel; and it seems to us that a furnace of this description should be useful for testing some qualities of fire-brick.

Among other features noted is an interesting furnace of patent design for heating metal ingots or bars preparatory to extruding them in compressing machinery working under enormous hydraulic pressures. This process, which is in operation by several of the metal smelters, offers an inducement for the use of gas-furnaces. Copper or alloy metals have to be very carefully heated, but not beyond a certain point; for it has been known to occur that, instead of a close-grained bar being extruded, a hot metal squirt has resulted, causing great danger in the immediate vicinity. We do

not suppose that this danger is sufficiently prevalent as to cause a selling argument in favour of the gas-heated furnace, but it certainly illustrates how valuable the gas-furnace is to the manufacturer, as it enables him to have complete control over the variations of furnace heats.

Gas undertakings in industrial centres will have noticed the great activity displayed by Newcastle, Sheffield, and Birmingham, and by the London Companies in the direction of gas-heating in the various spheres of industry. Gas-furnaces, and all there is to be said about them, should form part of the general scheme for developing gas sales. The manufacturer will be approaching more than ever gas undertakings for assistance in working out new schemes for utilizing gas fuel under many conditions; and it is therefore advisable for the selling department to have a general knowledge of modern gas-heated furnaces, the character of the work for which the various types are intended, as well as some knowledge regarding the melting-points of metals, metal alloys, their specific heats, &c. So much good work has been done in the past by gas undertakings for the promotion of business in connection with domestic heating, lighting, and also industrial lighting, that we feel the near future will show some records in promoting the use of industrial heating appliances of all kinds. With such an object in view, gas companies in the manufacturing districts would do well to have an example of one or more model gas-furnaces, which would enable any one of the staff to determine more or less what can be done in the way of heat adjustments, and also be useful for demonstration purposes to intending buyers of gas-furnaces. A view of the furnance test-room of the Sheffield United Gaslight Company (fitted with Richmond's furnaces) was given in the "JOURNAL" for June 14 last year, p. 693.

We are pleased to have the opportunity of congratulating the Richmond Company upon the important advance they have made in their furnace and laboratory appliance department; and the progress is emphasized by the information that an entirely new portion of their Warrington stove-works has been fitted up for adequately and promptly dealing with the daily increasing demand for this apparatus. The Company are busy preparing another complete catalogue of industrial gas apparatus (which will comprise from 50 to 60 pages); and this will illustrate in more extended form than we are in a position to do here the considerable developments that are taking place in industrial heating, and how manufacturers of the appliances are bestirring themselves in complying with every need. The Company also ask us to mention that, in order to do all possible to assist in the progress of the gas business in industrial applications, they will be pleased to place at the disposal of any gas authority their technical staff for following up inquiries, will provide drawings and specifications, and generally advise what is best for the particular trade for which the apparatus may be required. While such a business as the use of gas for new industrial purposes is undergoing development, the interests of the gas suppliers and makers of the appliances to be used are of a mutual order. Hence the suggestion.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Forty-fifth General Meeting of the Association was held last Friday, at the Liverpool Street Station Hotel, under the presidency of Mr. J. W. AUCHTERLONIE (Cambridge). This is the first time that an ordinary meeting of the Association has been held in London; and the large attendance of members indicated that the innovation was appreciated. The members and friends present first had luncheon together; and the business meeting was held during the afternoon.

The HON. SECRETARY (Mr. T. A. Guyatt, of Ely) read the minutes of the meeting held at Cambridge, on Sept. 23 last, and they were confirmed.

ANNUAL REPORT AND ACCOUNTS.

The annual report and accounts of the Committee were presented. The former recorded the proceedings of the Association during the year, and concluded with the following information:

The year commenced with a membership of 102. The Committee much regret to record the death of Mr. Chas. Ellis, of Yarmouth, who had been a member since 1890, and of Mr. W. H. Thrale, of Hessle, who was elected a member at the spring meeting. Eight new members were elected; leaving a membership at the end of the year of 108.

The accounts show that a debit balance of £3 3s. 1d. was brought forward from 1909, and subscriptions paid during the year amounted to £56 14s. The expenditure amounted to £55 8s. 1d., which leaves a balance of £1 17s. 8d., due to the Treasurer, and six subscriptions outstanding.

Much useful work has been accomplished by the Commercial Sections, and the matters discussed covered a very wide field. It cannot be too strongly impressed on those members of the Association who have not yet joined one of the Sections, that the benefits of these informal meetings are universally acknowledged by all who have taken part in them.

The PRESIDENT moved the adoption of the report and accounts.

Mr. JOHN BARTON (Peterborough), in seconding the motion, remarked that he was sorry to notice that there was a balance on the wrong side of the accounts. He thought they would have to do something to keep their expenses down somewhat. It occurred to him whether they could not make a joint report of the Eastern and Western Commercial Sections. He believed the expenses of the reports came out of the funds of the Association. In his opinion, if they had one report, instead of two from the two sections, it would answer the purpose just as well; and it would very likely make a difference of several pounds in the expenses. He threw this out as a suggestion to the Committee.

Mr. J. T. JOLLIFFE (Ipswich) pointed out that the accounts before them applied to the Association, and not to the Commercial Sections. He took it the latter paid for the printing of their own reports, and not the Association.

Mr. F. PATERNOSTER (Felixstowe) remarked that when the Commercial Sections started, they had no money in hand with which to pay for the printing of their own reports.

The PRESIDENT said he did not think they could call upon the Commercial Sections to pay for the circulation of their reports among the members of the Association who were not members of the Commercial Sections. If those members of the Association wanted the reports, they ought to pay for them.

The motion was unanimously carried.

PRESIDENT'S MEDAL.

The PRESIDENT said the next item on the *agenda* was one which gave him peculiar pleasure. Unfortunately at their last meeting at Cambridge, they had not the outgoing President (Mr. John Young) with them; and they were therefore debarred from having the interesting little ceremony that they would have liked to have taken place then. The pleasure, however, had only been postponed. Mr. Young was with them that day; and he had now the gratification of presenting to him the President's medal for his year of office. It was not on account of any intrinsic value the medal possessed that they presented it. But it would be a souvenir to Mr. Young of his occupancy of the very highest office they, the gas managers of the Eastern Counties, could confer upon him. His year of office was a most satisfactory one, and successful in every way; and he (the President) was sure that everyone present hoped that Mr. Young would be long spared to wear the medal, and attend the meetings of the Association.

Mr. YOUNG, in his acknowledgment, thanked the President for the kind words he had used in presenting the medal. Long after he had gone, the medal would show to someone or other that, at one period of his (Mr. Young's) existence, his brother engineers did him an honour that was much in excess of any merits he possessed. ["No, no."] He appreciated the honour very much; and now that the President was well on in his year of office, he would feel to the full what he had to say, that his own year of office was one of the happiest it was possible for any man to have. The support and kindness all the members extended to him so cordially helped a "lame dog" over the stile. [Laughter.]

NEW MEMBERS.

Mr. J. H. TROUGHTON (Newmarket) proposed that the names of the following three gentlemen be added to the roll of the Association: Mr. Herbert Green, of Stamford, Mr. A. F. Young, of Bury St. Edmunds, and Mr. Robert Wardell, of Cambridge. He remarked that it was very satisfactory to know the membership was still increasing.

Mr. J. DAVIS (Gravesend) seconded the motion, which was unanimously carried.

RECONSTRUCTING A RETORT-HOUSE.

Mr. F. PATERNOSTER (Felixstowe) next read a paper on the above subject. It is published on pp. 287-90.

At the close of the reading of the paper,

The PRESIDENT observed that the members had listened with great pleasure to the contribution, which was full of detail, and much valuable information. It described a class of work that most of them had had to undertake at some period of their lives. He did not know that there was very much they could discuss in the paper. But if there were any points upon which members would like to ask the author any questions, he would be pleased to reply to them.

There was no response; and the members at once addressed themselves to the next paper. It was entitled—

HEATING FLUELESS ROOMS.

Mr. J. H. BREARLEY (Longwood) was the author; and the communication, with the discussion, appears on pp. 295-300.

VOTE OF THANKS TO THE AUTHORS.

Mr. W. D. CHILD (Romford) said he had been asked to propose, on behalf of the members, a vote of thanks to the readers of the papers. Some three years or so ago, Mr. Paternoster placed before the Association a paper dealing with the details of his new arrangement of carbonizing plant, and it provoked a good discussion, both as to the character of the plant and its use. In the course of the reconstruction work now described, Mr. Paternoster seemed to have fallen on what was a source of frequent trouble to engineers—the provision of proper foundations;

and he might be congratulated upon placing before the members the methods he adopted to successfully and economically carry out the work he had had in hand. Mr. Brearley had dealt with a subject that he (Mr. Child) did not recollect had been brought before any of the Association meetings previously—the question of heating large halls; and he had certainly put into the several appendices a quantity of valuable information which would be useful to them all when dealing with matters of a similar character. He (Mr. Child) thought both the authors deserved the thanks of the Association for their papers.

Mr. J. Davis (Gravesend) seconded the motion, which was heartily agreed to.

Mr. Paternoster, in reply, thanked the members for this mark of their appreciation. He was only sorry his paper had not evoked a discussion. He must, however, admit that he did not expect much in this way; but he should have liked to have had a few questions from the members. Probably, they had expected a long discussion on Mr. Brearley's paper; and on this ground he could excuse them. The paper was the more likely one to create discussion. Nevertheless, he hoped that any information he had been able to give in the course of the paper might prove of use to anyone who required it at any future time.

Mr. Brearley also thanked the members, and at the same time he expressed his gratification to Mr. Paternoster for his paper. Although he did not speak on it, there were one or two points that had interested him very much. He was sure the contribution would be to him (Mr. Brearley), as to others, of much value for reference.

New Office-Bearers.

The President proposed that Mr. Paternoster be elected President for the ensuing year. He was one of the young men of the industry who showed great interest in its welfare; and, so far as the Association was concerned, he had taken an active part at all their meetings, and contributed valuable papers to the proceedings.

Mr. J. Carter (Lincoln) had great pleasure in seconding the proposition. The selection of Mr. Paternoster by the Committee, he was certain, met with the cordial approval of all the members.

The proposition was cordially approved.

Mr. Paternoster thanked the members for the honour they had done him in electing him President of the Association. He would during his year of office do his very best; and he hoped that at its close the members would not feel disappointed.

Mr. J. T. Jolliffe (Ipswich) said he had considerable pleasure in proposing that Mr. T. A. Guyatt be elected Vice-President of the Association. Three times it had happened in the twenty odd years that the Association had existed that they had elected to the vice-presidency, and then to the chair, members who had served them as Hon. Secretaries. They had been particularly fortunate in the men who had served them so long and so well in the capacity. Mr. Guyatt's services as Hon. Secretary had not been inferior to those of the Secretaries who had preceded him, and that was a happy augury. He was sure, as Vice-President, he would be equally serviceable to the Association.

Mr. John Young (Hull) remarked that he had much pleasure in seconding the proposition. They all knew Mr. Guyatt's value as Secretary; and, in his good nature, he would have continued the duties. But the Committee and the members of the Association felt that he must not be allowed to keep in the background, and that they must have him before long as President. This was the first step towards the position.

The proposal was cordially endorsed.

Mr. Guyatt said he must thank Mr. Jolliffe and Mr. Young for the kind words they had used in proposing the resolution, and the members for the hearty manner in which they had passed it. Personally, he should have preferred to have waited a little longer before taking on fresh duties. As, however, it was the wish of the Committee that he should go forward, he fell in with their views. He hoped he should carry out the duties of his new office to the satisfaction of the members; and he thanked them very much for the honour done him by electing him to the position. Proceeding, he proposed that Mr. Joseph Davis, of Gravesend, be appointed his successor as Hon. Secretary and Treasurer for the ensuing year. It was very kind of Mr. Davis to agree to take over the duties at a moment's notice. He (Mr. Guyatt) had hoped to induce another gentleman, who was quite competent for the post, to take over the duties; but unfortunately he eventually declined. Mr. Davis had kindly stepped into the breach; and from what they knew of him, they would, he (Mr. Guyatt) was sure, all agree that he would make an admirable Secretary.

Mr. Frank Prentice (Ipswich) seconded the motion. He remarked that the qualifications required for this office were many and varied; and he was sure Mr. Davis possessed them all.

The motion was heartily passed.

Mr. Davis, in acknowledgment, said it was a great surprise to him when he was approached that morning to ascertain whether he would take up the office of Hon. Secretary and Treasurer of the Association. He understood that it was necessary someone should occupy the post, in order to give Mr. Guyatt an opportunity of arriving at the position which he so well and worthily deserved, for the many years he had served the Association as Hon. Secretary. He (Mr. Davis) took it as a great compliment that the Committee had first nominated him for, and the members for their enthusiasm in electing him to, the position. He understood, however, that the appointment was somewhat of a temporary character; and, as he had accepted the position, he would endeavour to do his best during the time he occupied it.

Mr. Guyatt said they had now to elect new Auditors. Mr. Wimhurst, who had occupied the position of Auditor for a great many years, wished to be relieved of the duties, thinking that it would be to the benefit of the Association that the posts should go round occasionally. He (Mr. Guyatt) therefore proposed that Mr. W. Brown, of Brandon, and Mr. W. Beale, of Royston, should be elected Auditors. They were both Secretaries of their Companies; so that they were fully qualified to carry out the duties.

Mr. W. B. Farquhar (Ilford) seconded the motion, which was heartily carried.

Proposed by Mr. H. Duesbury (Hertford), and seconded by Mr. E. W. Smith (Chelmsford), Mr. J. B. Fenwick, of Retford, and Mr. A. Mitchell, of Bury St. Edmunds, were elected members of the Committee.

Place of Next Meeting.

Mr. Paternoster proposed that the next meeting be held at Felixstowe. He could assure the members that both his Directors and himself would give the members a very hearty welcome.

Mr. John Barton (Peterborough) seconded the motion; remarking that it was indeed kind of the Directors of the Felixstowe Gas Company to invite the members again so soon.

The proposition was heartily passed.

Vote of Thanks to the President and Officers.

Mr. A. E. Broadberry (Tottenham) said it gave him a great deal of pleasure to propose a vote of thanks to the President and officers of the Association for their services during the past year. He had not had the pleasure of holding office in the Eastern Counties Association, but he had had the pleasure in connection with another Association. From his experience, he knew that, in addition to the pleasure and honour that came to Presidents and officers, there was a great deal of hard work to be done. In order to provide the members with all the enjoyment they derived from the different meetings, much thought and attention had to be given to the arrangement of the details. It was so very easy to make a mistake; but so hard to make arrangements which would go through without the slightest hitch. The Eastern Counties Association had a happy record. All their meetings were looked upon as a great success, simply because of the attention bestowed upon them by the President and officers.

Mr. J. Davis (Gravesend) seconded the motion, which was heartily carried.

The President, on behalf of himself and his colleagues, thanked the members for the kind vote of thanks that had been accorded. It had been, as Mr. Broadberry said, a great pleasure to carry out the duties, which had been none too arduous; and he and his colleagues were gratified in having given satisfaction.

Lighting at the Festival of Empire Exhibition.

The President announced that, in a letter from Mr. S. Y. Shoubridge, in which he regretted that he could not be present at the meeting, he mentioned that, though the installation of lighting in the grounds of the Crystal Palace for the Festival of Empire Exhibition was not completed, the interior high-pressure lighting was; and if any of the members could spare time during the evening to pay a visit to the Palace, he was sure they would be interested.

This concluded the proceedings.

Institution of Civil Engineers' Annual Meeting.

Some points of general interest were mentioned last Tuesday, at the annual meeting of the Institution of Civil Engineers, in the report which was read by the Secretary. A deputation is to be received from the "Institute of Consulting Engineers" (which it may be remembered was recently formed) with a view of discussing the status of engineers and the practicability or impracticability of making engineering a "closed" profession. Reference was made to the report of the Committee which had been appointed to consider the question of reinforced concrete, and which Committee, it was said, was now engaged upon important experimental work. In the present state of the knowledge of the subject, it was thought that care was required in its use. Upon the ever-present topic of education, a Conference is to be called next month to consider the education and training of students in engineering. The "James Forrest" lecture will be delivered on June 28, and will be given by Dr. F. H. Hatch, on the subject of "Gold Mining in the Transvaal"—a matter, it will be admitted, not of that general interest and principle which has marked the previous lectures of the series. It is expected that the new building of the Institution will be ready for occupation in the spring of 1913, as the foundation work is now all but finished, and the superstructure will be begun next month. Professor Unwin has been elected President for the ensuing year; and among other members of the Council are: Mr. W. B. Bryan, the Chief Engineer of the Metropolitan Water Board; Mr. E. B. Ellington (Messrs. Ellington and Woodall), the President of the Institution of Mechanical Engineers; Mr. Maurice Fitzmaurice, C.M.G., the Chief Engineer of the London County Council; Mr. Walter Hunter, the Deputy-Chairman of the Commercial Gas Company; and Mr. H. E. Jones, formerly Engineer and now a Director of that Company, and Chairman of the Wandsworth and Putney Gas Company. The new Council take office on the opening of the next session in November.

THE RECONSTRUCTION OF A RETORT-HOUSE.

By F. M. PATERNOSTER, of Felixstowe.

[A Paper read before the Eastern Counties Gas Managers' Association. April 28.]

When the Association met at Felixstowe on May 1, 1908, I read a paper, entitled "Retort-House Working for Small Works," in which I described a few simple and inexpensive alterations made to the fittings of a bench of direct-fired retorts which effected such improved results that I felt the relation of the details would be of interest to the members.

The paper I now submit refers to the reconstruction of the retort-house referred to; and previous to the description, I think an explanation of the circumstances which led up to the decision to undertake this work will prove of interest, and probably save me from being accused of vandalism. The gas-works at Felixstowe are built on what is practically a bed of mud; and for some years it was known that the foundation of the retort-house was in a most unsatisfactory condition. There had been considerable settlement; and on every occasion when it was necessary to re-set a bed of retorts, the difficulty of providing proper flue-space round them was increased. The house, however, was not an old one; and when I read the previous paper, I felt satisfied that it would serve the Company's purpose for some years to come. During the year 1908, I advised my Directors that it would be well to consider the question of extending the manufacturing plant, not owing to the condition of the retort-house, but because of the rapid increase in the demand for gas, and also because the plant did not allow of much margin—in fact, during the summer of 1908 I had practically no reserve manufacturing plant at my command.

I did not think it wise to recommend the extension of a retort-house which I knew would have to be remodelled in the course of a few years. It was also at that time practically impossible to extend the house on the existing site; and I was aware that, by remodelling, it would be possible to largely increase the capacity of the house on the same ground space.

It was, however, impossible to commence this remodelling without first providing additional plant; and after full consideration, I recommended my Directors to instal a small water-gas plant. In recommending this, I not only had in view the object of increasing the manufacturing plant, which would enable me to gradually remodel the retort-house, but I felt that it would assist in the disposal of coke, with which there had always been difficulty at Felixstowe, owing to the fact that as much, or more, coke is produced in the summer as in the winter, and that August is the month of maximum production. This difficulty, I believe, also occurs at most seaside towns and holiday resorts. There happened to be an existing building on the works well suited to contain the plant; and it was installed in the spring of 1909. It is a Dellwik-Fleischer blue water-gas plant, arranged for conversion, if required, to a carburetted water-gas plant, and was erected by Messrs. R. & J. Dempster, of Manchester.

I may say that during the summer of 1909 this water-gas plant proved a great blessing, for the retort-settings were in a bad condition; and I do not think we should have sailed comfortably through the season on coal gas alone. I was also able to keep down the stock of coke, and have done so since, obtaining a better average price, owing to the fact that there has been no necessity to sell at a low price on rail to keep the yard clear. I am fully satisfied with the results obtained from the plant, about which, and the question of admixture and enrichment, perhaps I may say more at a later date.

I have mentioned that the retort-settings were in a bad condition during the summer of 1909. This was not due to age, but to further settlement or fracture of the foundation. It was with the utmost difficulty that the heats were maintained at a gas-making level; the flues were continually blocking, and steam rose into the settings from the foundation. In the case of one bed, which was shut down at the end of the season, it was very soon found that retorts and brickwork were becoming damp, and that water was actually collecting in the retorts. I might here mention that the ash-pans were let into the foundation and were below the water level on the surrounding marshes. I came to the conclusion that the concrete was either perished or badly cracked, and that the heat from the furnaces from the settings at work was causing the water to evaporate and rise in the form of steam into the flues of the settings; and in the case of the setting not at work, the steam was condensing and gradually soaking into the retorts and brickwork.

I was naturally very alarmed at this discovery; and on reporting the matter to my Directors, it was felt that the consequences might be serious if the reconstruction of the retort-house was long delayed. I was therefore instructed to prepare a scheme for the necessary work to be carried out at the earliest possible date. The details of the scheme adopted I propose to briefly describe in this paper, with the assistance of a few photographs; and I trust the information will prove of interest to the members.

The dimensions of the retort-house were 47 ft. long, 37 ft. 4 in. wide, and 17 ft. high to the eaves; the walls being of red brick 14 inches thick. The roof consisted of five steel principals, with angle iron purlins covered with 24 inch by 12 inch slates. There was a louvre ventilator for the full length of the roof, covered with No. 20 gauge galvanized iron. The foundation was an ordinary bed of concrete 2 ft. 6 in. thick over the whole site.

The building had settled considerably in one corner; and levelling across the gable end, the eaves level on the works side of the house was found to be about 13 inches below that of the opposite wall.

A boiler-house and men's mess room had a short time previously been erected, in the form of a lean-to on the works side of the retort-house; and the weight of the wall which had settled was taken by the new foundation. Three substantial piers were also built, each one corresponding to a roof principal. This work effectually stopped any further settlement of the house; and made it quite safe to increase the height of the wall.

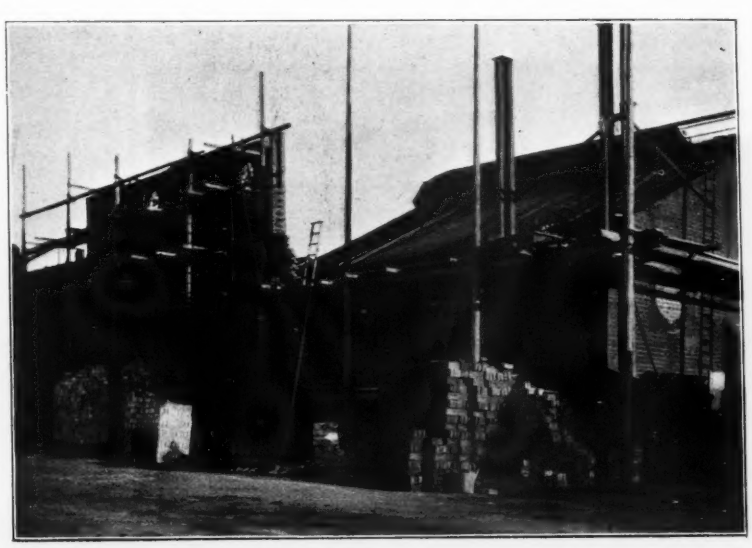
It was decided to convert this building into a stage-floor house for full-depth regenerator settings; and to obtain the necessary height, the roof was raised 13 feet—the walls being built up to the level of the new eaves. The length of the house was also increased by taking in a portion of a coal-store and of the water-gas house. The internal dimensions of the new building are 60 ft. by 37 ft. 4 in. by 30 ft. high to the eaves. To increase the length of the roof, three new principals and one gable-end framing were supplied; the angle purlins and the louvre ventilator also being extended.

For supporting the roof there are six double stanchions, composed of 10 in. by 5 in. by 30 lb. steel joists; the inner joist, which is 29 ft. 6 in. long, being carried down the side of the old walls, and secured thereto by means of bolts passing through the wall and provided with cast-iron wall-washers. The base of each stanchion is fitted with a shoe, which is bolted with rag bolts to the foundation. The outer joist, which is 12 ft. 6 in. long, extends from the top of the wall to the underside of the eaves girder, and is provided with shoes and cleats. Four of these double stanchions are fixed on the charging side of the house, and two only on the opposite side. This number I considered quite sufficient, owing to the existence of the previously mentioned piers. On the charging side, there are also five single stanchions, composed of 10 in. by 5 in. by 30 lb. steel joists, 12 ft. 6 in. long, fixed to York stones on the old wall by means of steel shoes and rag bolts. The bases of the outer joists of the double stanchions are also fixed to York stones by means of rag bolts. On this side of the house, there is a stanchion to correspond with every principal, and one for the gable end.

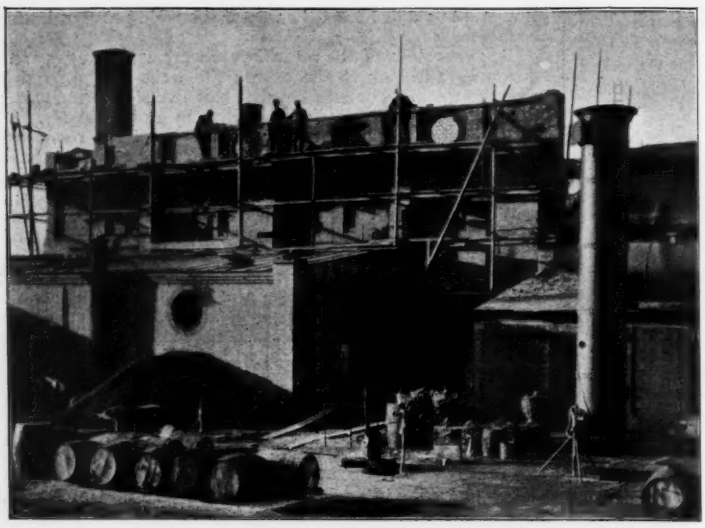
There is a 6 in. by 5 in. by 25 lb. eaves girder fixed along the full length of each wall, bolted in every case to the upright stanchions; and in those positions on the back wall where there are no stanchions to correspond with the principals, it is bolted to York stones with rag bolts—the York stones being bedded into the brickwork. The shoes of every principal are bolted to the eaves girders.

Round each stanchion on the charging side of the house, brick piers are built, 18 inches wide by 14 inches thick; at the gable end, a pier 2 ft. 3 in. wide by 14 inches; and between the piers, panels of brickwork 9 inches thick. There are circular openings in four of the panels 4 feet in diameter, surrounded by two rings of 4½-inch brickwork, in which are inserted ornamental cast-iron ventilators. Corresponding piers and panels are built up on the opposite wall, at one end of which there are two openings, each 8 ft. by 4 ft. 6 in., one above and one below the stage floor, used as exits for coke and ashes respectively.

The whole of the brickwork, excepting the panels, is built in



Heightening the Front Wall of the Retort-House.



Elevation from the Works.

cement; the latter being in mortar. The bricks used for the wall facing the road are best wire-cut red, and for inside work, and also for the facing of the opposite wall, best Fletton.

The gable end adjoining the water-gas house and coal-store was filled with steel framing and covered with No. 18 gauge galvanized corrugated iron down to the lines formed by the roofs of the other buildings. In this gable framing, there are three steel louvre ventilators.

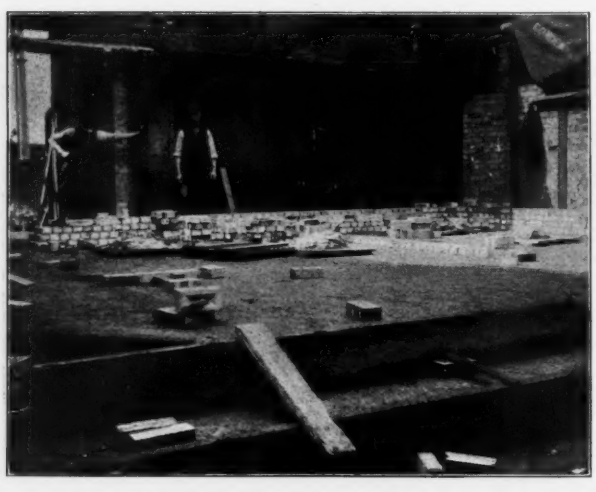
The opposite gable end has not been completed, as it is intended at some future date to extend the house in this direction. The old brick gable has been left standing. One of the new principals is fixed immediately over it, and for the time being the space left is filled in with rough boarding.

In addition to raising the walls of the retort-house, it was necessary to build up one wall of the adjoining coal-store, so as to obtain head-room above the new stage floor. New wooden rafters and purlins were supplied, and the whole roof covered on the new slope with No. 20 gauge galvanized iron.

The conversion of this retort-house and coal-store was placed in the hands of a local firm of builders, who commenced work on March 29, and completed it on June 11, 1910.

During the progress of this work, we were preparing for the new settings. Of the five beds of direct-fired retorts, two were demolished, and the remaining three, together with the water-gas plant, constituted the manufacturing plant during the period occupied by the alterations.

The foundation for the retort-settings was a matter for serious consideration. An artesian well was bored close to the site a few years previously; and I give herewith the information we then obtained with reference to the strata, which will give an idea of the nature of the ground upon which we have to build.



Completion of the Foundations and Commencement of the Retort-Settings.

Borings of Artesian Well.

	Ft.	In.
Made soil	2	0
Mud platter	31	0
Sandy loam	3	6
London clay	5	6
Ballast, sandy and beach pebbles	10	0
Stiff loam	2	3
Ballast as before	5	9
London clay	4	6
Running sand	4	6
Ballast	10	0
Mottled clay	1	0
Light rnnniug sand	3	9
Mottled loam	5	3
Green sandy loam	1	6
Mottled loam	4	0
Flint bed	1	0
Chalk reached		

The land in the neighbourhood of the gas-works is not of the best for building upon; and on the advice of a local engineer having great experience of foundation work in the district, it was decided to support the weight of the new settings on piles. Two settings were to be erected; and six piles were driven so that two came under each main wall—a reinforced concrete foundation being placed over the piles.

Pitch-pine logs 12½ in. by 12½ in. were selected for the piles. The short time in which the work had to be finished precluded the use of ferro-concrete, which I should very much like to have adopted for this work. We commenced driving with a 40 feet length. This, however, was not sufficient to obtain a proper set; so another 10 feet length was added. The joint was made by butting the two ends, facing the four sides with 11 in. by 4 in.

The Completed Elevation of the Retort-House.

timber 4 feet long, tapered at the lower ends; each piece bein fastened with eight 9-inch spikes to the piles, and the whole being bound round with hoop iron. The joint was well tarred, as also was the whole pile. The set of No. 1 pile was obtained at a depth of 44 ft. 11 in.; No. 2, at a depth of 44 ft. 4 in.; No. 3, 44 ft. 8 in.; No. 4, 44 ft. 9 in.; No. 5, 45 ft. 5 in.; and No. 6, 44 ft. 7 in. So that in every case an extra length had to be jointed on to the first 40 feet. Manual labour only was used for driving the piles; the monkey, weighing 25 cwt., being raised with an ordinary winch, and released by opening the nippers with a cord when the desired height had been reached.

The final sets obtained with the last ten blows were as follows:—

	Drop of Monkey.	Distance Pile Driven.
No. 1 pile	8 feet	2 inches
No. 2 ,,	6 ,,	2 ,,
No. 3 ,,	8 ,,	2 ,,
No. 4 ,,	6 ,,	2½ ,,
No. 5 ,,	8 ,,	2 ,,
No. 6 ,,	8 ,,	1 ,,

Each pile was provided with a proper shoe, having a cast-iron tip, fastened with wrought-iron straps to the pile; also a cast-iron cap. It may interest the members to know that the Dutch formula, as given in Molesworth's pocket book, was used for determining the final set of the piles.

$$\text{Safe load} = \frac{W_2 H}{K D (W + w)}$$

D = Average set with last four blows.
W = Weight of monkey, in hundredweights.
w = Weight of pile, in hundredweights.
H = Fall of monkey, in inches.
Factor K = 10.

We have already this year demolished the remainder of the old settings, driven six further piles, and placed over them a similar foundation to that of last year, upon which the contractors are building an extension of the retort-bench. The pile-driving this year had to be done under the roof; and as a result of last year's experience, I provided 50 feet for each pile. Owing to limited head-room, however, they were driven in 25 feet lengths. To show the uncertainty of pile-driving, the first pile this year had to be driven 65 ft. 6 in. before a satisfactory set was obtained, though it is within 10 feet of one which found a set at 45 ft. 7 in. This was rather a surprise; but we obtained a set with No. 2 at 43 ft. 6 in., No. 3 at 45 ft. 6 in., No. 4 at 50 ft. 2 in., No. 5 at 46 ft. 2 in., and No. 6 at 44 ft.

The holes which were cut in the old foundation for inserting the piles were filled in with concrete; and above the caps of the piles, and also over the part of the surface of the old foundation which was required for the new work, a bed of concrete was placed. This was reinforced with steel joists and iron rods; the joists being those previously in use as bracings for the old settings. The concrete was formed of shingle, brick rubble, and Portland cement in the proportions of six of the aggregate to one of cement. This block of concrete measures 28 ft. 9 in. by 23 ft. 2 in., and is of an average thickness of 2 ft. 6 in. above the old foundation. Pockets, 12 in. deep, were formed in this new foundation for all stanchions used for bracing the new settings. The roof over the section where the piles were driven was entirely removed; and the portion of the house containing the retort-settings at work was protected by a temporary screen, consisting principally of scaffold poles, boards, galvanized iron sheets, and tarpaulins.

We commenced demolishing the two old beds of retorts on March 31. The pile-driving occupied 14 days (being finished on April 30), and the foundation was completed ready for the erection of the settings on May 7, 1910.

Two regenerative settings of eight retorts each were erected on the new foundation. The unit of eight is admittedly too large for a works of the size of Felixstowe. After full consideration, however, I decided that we must have a minimum of sixteen retorts in the first section; and there being no space for a third arch, it was necessary to get this number of retorts into two settings. This section of the bench is 22 ft. 3 in. over all, made up of one 2 ft. 3 in. end wall, two 18-inch division walls, and two arches 8 ft. 6 in. wide. The depth of the bench from face to back wall is 14 feet below, and 13 ft. 5 in. above, the stage floor; and the total height from the foundation is 20 ft. 2 in. The regenerator is full depth; there being 8 ft. 6 in. head room under the stage floor. The main flue is carried up to the top of the bench, upon which is erected a steel chimney shaft of ¼-inch metal, 20 feet long, 2 ft. 6 in. internal diameter, lined 10 feet up with 4½-inch fire-brick. The top of the bench is paved with angular contact air-bricks set in cement mortar; the air passages being sealed on the outside courses with ordinary 9 in. by 4½ in. by 3 in. fire-bricks.

The retorts are ⏢-shape, 22 in. by 16 in. by 10 ft. long inside; being of the same dimensions as those in the old settings. The arches are narrow for eight retorts of this size; but owing to the limited amount of space, this was unavoidable in the first section. In the second section, to be erected this year, there will be three arches, 9 feet in width.

The bench is braced with 10 in. by 6 in. by 42 lb. steel joists, three for each end wall, connected with 2-inch tie-rods. At the back and on the face there are three 8 in. by 5 in. by 28 lb. rolled steel joists; the former being in one length and the latter in two, divided by the main joists of the stage floor to which they are connected. All the stanchions are protected where necessary with cast-iron shoes. Across the top of the bench, there are three 6 in. by 5 in. by 25 lb. rolled steel joists connected to the back and front bracings, and on which are supported the hydraulic mains. The front walls of the combustion chamber and of the regenerators are braced with 4 in. by 2 in. by 6 lb. rolled steel joists. The mouthpieces are braced across the front of the settings with 5 in. by 2½ in. by 11 lb. steel channel bolted at each end to the upright stanchions.

The ascension pipes are of cast-iron, 6 in. internal diameter; and the bridge and dip pipes of the same pattern as those used for the old settings, as described in my paper on "Retort-House Working."

The hydraulic mains are of ¼-inch curved steel plate, 2 ft. by 2 ft. inside measurements, with ⅜-inch top and back plates and $\frac{5}{16}$-inch end plates; the latter being carried down square, and having feet formed of 2½ in. by 2½ in. by ⅜ in. L irons for resting on the cross joists of the settings. Angle iron 2½ in. by 2½ in. by ⅜ in. is also used for fastening the top, side, and end plates to the ¼-inch steel plate. There is a 4-inch tar outlet, fitted with a 4-inch cast-iron plug valve, for each main, and a 4-inch cast-iron main connecting to the tar-column. Each main has also a 1½-inch water supply and a 2-inch liquor flow pipe; the latter being just below seal level and connected with the tar column. There are also two sight glasses in each main. The mains have 10-inch cast-iron outlets fitted with Cort's 10-inch weir valves.

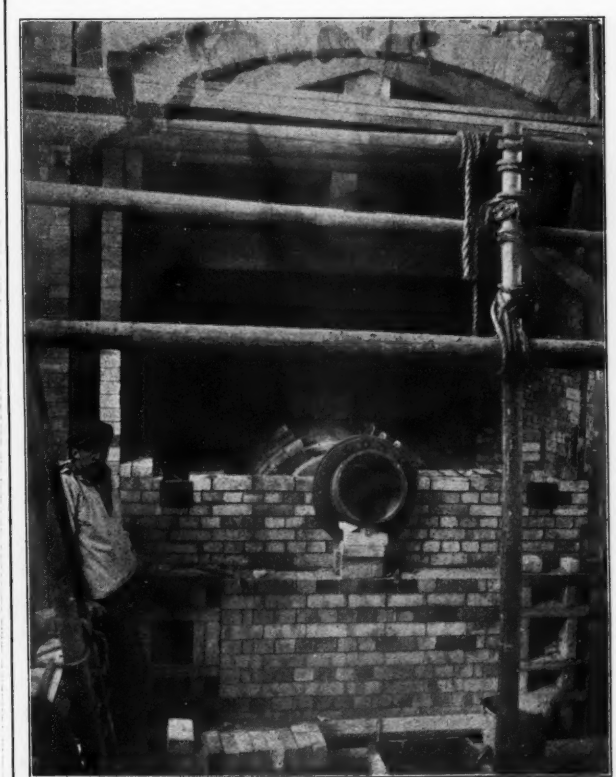
The tar-column is rectangular in design, 10 in. by 14 in. by 15 ft. long, made of ¼-inch steel plate, fitted with a 4-inch weir valve to regulate the seal in the hydraulic mains, and having an overflow pipe, 2 inches in diameter. It is also fitted with a 1½-inch water supply pipe and a 1-inch equilibrium pipe.

All levels were adjusted, as explained in my previous paper; and the only addition to that scheme is the weir-valve on the tar-column, to adjust the seals and the return-liquor pipe from the column to the hydraulic mains. The latter pipe allows for constant circulation, and, in my opinion, is a great improvement on the usual single pipe through which tar flows to the column, and liquor also has to flow back in the opposite direction to take its place.

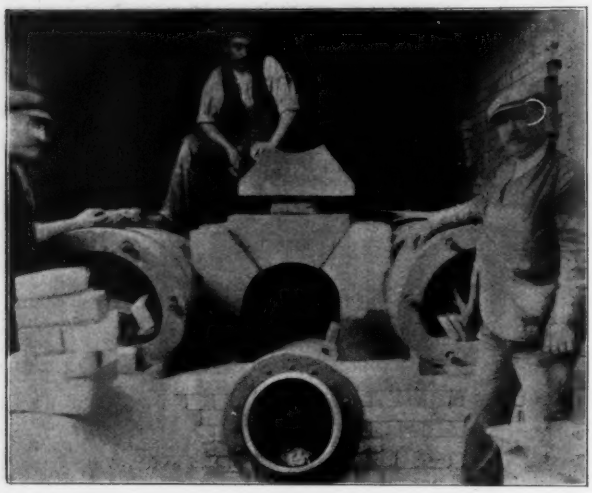
Constructing the Regenerator.

The foul main is 12 inches in diameter, made of ¼-inch steel plate. At the present time, it is connected to the original foul main by means of a temporary 6-inch cast-iron pipe. This main is supported from the joists crossing the settings by cast-iron standards.

The retort-house governor is of the Reeson type, 6-inch size. This governor is a dry one; and I may say that it is giving every satisfaction.



View of the Secondary Air Ports over the Furnace Crown.

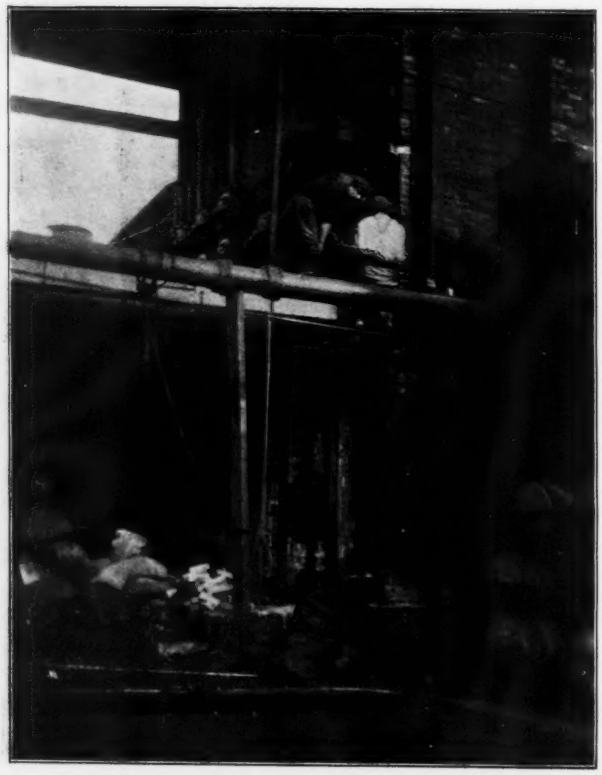


Construction of the Combustion Chamber.

The stage floor and passage at the end of the bench consist of four main joists, 10 in. by 5 in. by 30 lb., supported on brick piers inside the front wall of the house, and attached to the bracings of the settings at the other end. On these joists is laid ¼-inch plate-steel troughing 6 inches deep; and this is filled in with concrete, composed of shingle and cement in the proportions of 6 to 1, and paved with best Staffordshire chequered blue bricks, 9 in. by 4½ in. by 2 in. The width of the staging in front of the settings is 21 ft. 2 in.; and the length of the first section, including the width of the passage, is 27 ft.—the passage itself being 5 ft. 6 in. To support the floor of the passage between the main joist and the bench, there are three lengths of 6 in. by 5 in. by 25 lb. rolled steel joists under the troughing, connected at each end respectively to the main floor joist and the end bracing of the bench.

As a continuation of the passage, there is a barrow-way, almost in the form of a quarter-circle, running out into the yard over the coke floor for a total length of about 98 feet. This barrow-way is a steel structure, the uprights of which are formed of 6 in. by 3 in. by 12 lb. rolled steel stanchions placed in pairs about 14 feet apart, and each pair is braced from top to bottom with 2 in. by 2 in. by ¼ in. angle iron. The sides of the flooring of the barrow-way are formed with 8 in. by 4 in. by 18 lb. rolled steel joists fastened to the uprights, and 4 in. by 2 in. by 6 lb. rolled steel joists are fixed between them at intervals of 2 ft. 6 in.

The space between the two side joists is 6 feet. It is filled in with concrete, and paved with best blue Staffordshire chequered bricks in the same manner as the stage floor. Cast-iron standards



The New Settings from the Old Charging Floor.

are fixed at intervals of about 7 feet on both sides of the stage, between which there are two rows of chain. The height of the staging is about 10 ft. 6 in. above ground level; and the base of the uprights have shoe-plates attached, and are embedded in concrete blocks.

A platform 20 ft. by 12 ft. is formed at the exit from the retort-house; the approach to which is by means of a steel staircase. There is a corresponding passage to the above under the stage floor; and this, together with the flooring in front of the clinkering doors is also paved with blue bricks, which are laid on the concrete foundation and bedded in cement.

The contract for the settings, stage floor, and all ironwork was placed in the hands of Messrs. E. J. & J. Pearson, of Stourbridge, who commenced work on May 9; the first bed being charged on July 27, and the second on Aug. 3. All the ironwork, except the barrow-way, was supplied by Messrs. R. & J. Dempster as the Sub-Contractors to Messrs. Pearson.

In addition to the contract for the settings and staging, it was necessary to provide a crane for the lifting of the coal to the stage floor; also new charging apparatus for the two settings, consisting of a travelling crane and patent blocks supplied by Messrs. Herbert Morris and Bastert, of Loughborough.

In conclusion, I think it will be interesting to state that the total cost of the work just exceeded £2000, which sum includes, in addition to the items mentioned in this paper, the demolishing of the old settings, the necessary alterations to connections, and the connecting up of the new work.

EXPERIMENTS WITH BALLOON GAS.

The question of the deterioration of balloon gas by diffusion through the envelope, has been studied by Messrs. Caro and Schück; and an account of their interesting researches appeared in a recent issue of the "Chemiker-Zeitung."

The object of the investigation was to ascertain the changes of hydrogen due to diffusion through the envelope of balloons of various shapes. For some preliminary experiments, a small test balloon—made by Messrs. A. Riedinger—was used. It had a capacity of 96 litres, a length of 151 centimetres, and a maximum diameter 33 centimetres; and it weighed 820 grammes. The envelope was made of doubled balloon fabric, and had five glued seams parallel to the longitudinal axis. The analytical data obtained were not of great value, showing, together with the deflation observed, that there was considerable leakage—no doubt largely due to the seams being quite out of proportion to the total surface of the envelope.

In order to obtain results of practical value, the dirigible "Parseval VI." was experimented with. This airship has a capacity of 6500 cubic metres, a length of 80 metres, and a maximum diameter of 14 metres. The weight of the car is 80 cwt.; and it has two air ballonets. On Aug. 10-13, it was freshly charged with electrolytic hydrogen, carried in steel bottles under 150 atmospheric pressure. The hydrogen showed the following composition: Oxygen, 0·27 per cent.; hydrogen, 98·5 per cent.; and nitrogen, 1·23 per cent. The density was found to be 0·087, corresponding to a buoyancy of 1181 grammes per cubic metre.

The gas samples were taken at different levels: A, 2·5 to 3 metres from the top; B, in the middle; C, 2 metres from a bottom valve. Four sets of samples were taken, extending over a period of four weeks, during which the balloon made a number of ascents (all on hot days), with supplementary charging of fresh gas as required. After that time, the original composition of the gas had deteriorated to: Oxygen, 1·43 per cent.; hydrogen, 92·07 per cent.; and nitrogen, 6·5 per cent. The experiments were then discontinued. The results were somewhat ambiguous; but they showed with certainty that (1) the gas formed layers in the balloon when resting, (2) the nitrogen diffused more readily through the envelope than the specifically heavier oxygen, and (3) the constituents of the air diffused more rapidly into the balloon the purer the original hydrogen was, for the gas lost 3·1 per cent. of hydrogen during the first three hours' voyage, and only 1·2 per cent. after a further twelve hours.

The formation of layers was studied more closely with the aerostat "Reiher," of the Royal Balloon Battalion (capacity 665 cubic metres, diameter 11 metres, and weight 169·5 kilos.), which had only made two ascents previously. After filling the balloon with electrolytic hydrogen (oxygen, 0·28 per cent.; hydrogen, 99·01 per cent.; and nitrogen, 0·70 per cent.—buoyancy, 1190 grammes per cubic metre), a system of five aluminium tubes of varying length was introduced through the charging hose, held together by an aluminium ring, mounted on wood. This permitted sampling in heights of 10, 8, 6, 4, and 2 metres from the bottom of the balloon. Twelve sets of samples, extending over three weeks, were taken from the stationary balloon; and a great number of figures were obtained by their analysis, which corroborated the former experience with regard to the formation of layers and the preferential diffusion of nitrogen over oxygen. Figures agreeing within the limits of experimental errors with those found by analysis only were obtained by calculation of buoyancy and composition of gas before and after the experiments, showing the amount of hydrogen lost from, and of air diffused into, the balloon. The experiments are being continued.

LIGHT AND ILLUMINATION.

At the Meeting of the Illuminating Engineering Society at the Society of Arts yesterday week—Mr. R. J. WALLIS JONES presiding, in the absence of Professor Sylvanus Thompson—the members had their attention directed to questions affecting light and illumination, through papers prepared by Mr. HAYDN T. HARRISON, M.Inst.E.E., and Mr. P. J. WALDRAM, F.S.I.

The Ratio of Light to Illumination.

This was the title of Mr. Harrison's paper; but the text of the paper itself, as the author admitted, did not exactly justify the title. The object his paper was mainly directed to serve was to get at something like harmony in relation to terms used in connection with the science of illumination. In the opening lines, the author said that only within the last few years has artificial illumination been dealt with as a separate science. Therefore it is not surprising that some of the terms connected with it are often used with different meanings, thus leading to confusion. He agrees with Mr. Trotter's definition of illumination as depending simply on the quantity of light falling upon a surface, and that it has nothing to do with the colour or reflecting value of that surface. Therefore, it would be, strictly speaking, inaccurate to state that an instrument such as the Holophane "Lumeter" indicates the illumination except when pointed at a white screen of similar material to the screen in the instrument itself, and which is illuminated to a predetermined degree.

In order to demonstrate the point, the author carried out the following experiments with his "Universal" photometer. This instrument consists of a screen capable of angular displacement; thus varying the degree to which it is illuminated by a standard lamp. The screen is used in conjunction with the Whitman sector flicker disc, and thus indicates the degree of illumination derived from a source of which the candle-power value can be calculated. The advantage of using this instrument is that, by replacing the standard comparison screen by the various tinted wall-papers which Mr. Waldram used in his experiments (referred to in the second paper), the author said he could ascertain very accurately the increased illumination necessary in order that the rays reflected from such wall-papers should have the same effect on the eye as when a white paper of similar surface to the photometer screen was used. The results of the experiment were:—

Screen.	Colour.	Increased Illumination Necessary.
1.	Bright red	3·5 times
2.	Dull cardinal red	6·5 ,,
3.	Medium blue	4·8 ,,
4.	Light blue	3·2 ,,
5.	Dark green.	7·0 ,,
6.	Light green	2·2 ,,

The next experiment was to ascertain the value of the light reflected from the area of these papers, compared with that of white blotting paper; and it was found that, though these tests were made under very different conditions and very roughly, owing to the short time available, they to all intents and purposes corroborated the figures given above—thus proving that an instrument of the "Lumeter" class measures correctly the irregular reflecting value of a surface.

It is interesting to note here a remark of Mr. Trotter's: "Such terms as illumination, brilliancy, brightness, intensity, and luminosity are generally employed by different writers to express different ideas, and are often used in a confused, vague way." This remark, unfortunately, is quite as true to-day as when it was written. Therefore it is not surprising that it is difficult to fix definitely a unit which accurately describes reflecting value; and the author doubts whether a better word than "luminosity" could be chosen. Sir William Abney describes luminosity as brightness resulting from illumination, which is exactly what the "Lumeter" measures. But in this case are we to regard "luminosity" as denoting luminous flux per unit area, so that it would be expressed, say, in lumens per square inch? or as denoting candle power per unit of area?

With regard to the other terms, personally the author uses them in the following sense:—

(1) *Light*—The emanations from a light source.
(2) *Illumination*—The extent to which anything is illuminated—Foot candles.
(3) *Brilliancy*—Refers to primary light source, and is candle power divided by area.
(4) *Intrinsic Brilliancy*—Candle power per unit surface (square centimetre).
(5) *Brightness and Intrinsic Brightness*—Same as brilliancy.
(6) *Luminosity or Luminous Intensity*—Same as brilliancy, but applied to secondary sources of light.

The author only puts the above table forward as suggestive, and would like to see the terms "brilliancy" and "brightness" always applied to primary light sources, in view of the considerable confusion due to their indiscriminate use.

If luminosity or luminous intensity is used as applied to indirect or secondary sources of light, the value of these sources could be stated in lumens instead of candle power, which would simplify matters considerably. For example, if any given area in a room could be stated to be illuminated to a certain degree in foot-candles by direct light from a source *plus* so many lumens in the form of indirect illumination, we should know at once the relative reflecting value of the surroundings of the light source, and also the likely density of the shadows. This would not be a difficult thing to measure, as, by shading the direct light from the measuring surface, the illumination due to the lumens (indirect lighting) only would be obtained.

Louis Bell points out that altering the position of the primary source of light in a room does not affect the illumination seriously if the walls and ceiling diffuse strongly—*i.e.*, have a high degree of luminosity; while, if they are dark, the change is decidedly unfavourable. The author goes further than this, and says that, if the walls and ceiling have a 100 per cent. luminous efficiency, and the light, though invisible, is placed so as to illuminate them, the resulting illumination will have a maximum efficiency. On the other hand, if the walls and ceiling have no luminous efficiency, and no direct illumination is derived from the source of light, the illumination will be zero. The various stages between these two limits will be inversely proportionate to a table similar to that given in the early part of the paper. If this theory is correct, the illumination at any part of the room will be proportionate to the direct illumination *plus* the illumination due to light reflected from the surfaces visible from the point of measurement.

The measurement of the illumination derived from all sources is, of course, easy; but to ascertain the light value of the original source of such illumination is a very different matter. The importance of ascertaining this light value arises when a question of cost and efficiency is under consideration; and the only satisfactory method is either to eliminate all reflecting sources, or to remove the lamps to the test-room. In either case the question presents itself as to what is the light source. Is it the lamp only or the lamp *plus* the globes and reflectors, which may considerably enhance its value as an illuminating agent? It must be borne in mind that globes and reflectors only enhance the lamp's value as a light source for the purpose of giving direct illumination, and often depreciate its value from the point of view of the reflected illumination derived from the surrounding objects. Therefore, the value of the naked lamp alone must be known; and this is, of course, easy to ascertain by the usual photometric methods. The value of such a lamp *plus* globes or reflectors is a more complicated matter, owing to the area of the light source being increased, and thus interfering with the square law of photometry. Under these circumstances, unless means are available for obtaining the profile curve of lighting, the only way to find the illuminating value of a light source, including reflector, &c., is by ascertaining the illuminating results. For this reason the author suggests that all makers of lamps who wish the apparatus supplied by them to be used to the best advantage, should accurately state the candle power derived at various angles, and should not be content with stating either the maximum, horizontal, or mean spherical or hemispherical candle power. If makers would do this, the lamps or combinations of lamps with globes and reflectors would be divided into classes, which would not only greatly assist illuminating engineers, but would result in the goods supplied being used to the satisfaction of the public.

This naturally leads to the consideration of the relative merits of lights with reflectors or globes which increase the illumination in the direction required, *versus* unprotected lights from which good illumination is obtained by using the walls or ceiling as reflectors. It is obvious that, as regards efficiency, the use of reflectors will generally have the advantage. Take, for example, a room with white ceiling and walls. The upper hemispherical rays are reflected back into the room and usefully increase the illumination. But, on the other hand, a reflector placed directly over the lamp, provided it receives all the upper hemispherical rays, will even more efficiently direct them on to the remainder of the room where illumination is required, but will leave the upper part of the room in comparative darkness. In the case of a room which has not a white ceiling and wall-paper, the efficiency of a reflector will be comparatively higher; and, what is even more important, it will remain constant, owing to the fact that it can be cleaned more often than it is convenient to whitewash the ceiling and repaper the walls of a room. But the physiological (light sensation) effect is different, because the illumination is derived from a single source, while in the other case it emanates from all directions. The author is prepared to grant that a person entering a room with light coloured ceiling and walls will often state that it is better illuminated than a similar room where the surroundings are dark coloured. Nevertheless, the illumination in the latter case may be better on the parts that require illumination than in the former; and possibly the physiological effect would eventually prove more generally satisfactory as the high luminosity of the surroundings would tend to close the iris—thus producing a trying effect on the optic nerve if an attempt to work is made under these conditions. This is where the province of an illuminating engineer becomes very similar to that of a physician. The illuminating engineer will have to learn the effects which are most likely to please his clients.

Effect of Wall-Papers on Illumination.

This was the title of Mr. Waldram's paper. He spoke first of the strangeness of the fact, when one considers the enormous development of the gas and electric lighting industries throughout

the world, that few exact rules should exist which would enable any given degree of illumination to be predetermined from illuminating units of given candle-power distribution. The problem is one which comes constantly, almost daily, before every one connected with the huge modern industry of artificial lighting—from the officials of the great supply companies down to the small builder or the village gas-fitter. But it would be difficult to find anyone who could say what illumination on a table or a desk could be expected from illuminating units of given candle-power distribution in the presence of walls and ceilings of given colours. The architect and the householder have the doubtful pleasure of feeling that the knowledge upon which they are forced to rely is still largely guesswork.

A great amount of labour and research has been devoted to determining with great exactness what flux of light is emitted in different planes by different units of illumination. But it is difficult to apply such knowledge to practical problems of illumination, because the important factor of reflection and counter-reflection from walls and ceilings has been neglected or shirked on account of its real or supposed difficulty. A not unusual way out of the difficulty is to calculate the direct flux only, leaving any increase due to reflection to make up for subsequent deterioration in lamps or mantles. This would be reasonable if one had even an approximate idea of the relative values of the two. It is, however, a direct temptation, in cases where economy is of importance, to specify those shades which tend to concentrate the rays of light into a given specified working plane, leaving the walls and ceilings objectionably dark, and the working plane under the disadvantage of a strong undiffused light, which is very liable to cause shadows and glare from glazed surfaces. The secret of all successful artificial illumination is to approximate as closely as possible to those conditions of daylight under which our eyes have developed. The property which all artificial illuminants lack is diffusion. The eyes accept without protest huge differences in range of daylight because it is so perfectly diffused by the enormous depth of atmosphere through which it must pass; but a difference of even 2 or 3 foot-candles in artificial illumination will cause considerable inconvenience. Optically, it would appear that the correct policy is to utilize as fully as possible the reflecting and diffusing properties of walls and ceilings, and to afford relief from trying uniformity by using coloured surfaces, in positions where they will catch the eye without unduly reducing the efficiency of the installation.

What is expected of any scheme of artificial illumination is as follows:

(1) That the working or table plane of the room shall receive an equable light, as much diffused as possible, sufficient for the purposes for which the room is to be used without being excessive.

(2) That the walls and ceilings should receive and reflect such an amount of light that they appear to be neither too glaring nor too dull, with all the essential architectural features brought into sufficient prominence.

Up to the present, it has been customary to more or less neglect the wall and ceiling illumination, and to consider the working plane illumination as being a criterion of the whole. This is not only wrong; it is injudicious. An interior may have an excellent illumination on the table; but not one person in a hundred would give it credit for being a well-lit room on that account. The light reflected by the walls and ceilings has a psychological effect upon those who use, judge, and pay for it, which neither the architect nor the lighting expert can afford to disregard. Commercially, too, the reflected light from walls and ceilings is important. Gas or electricity is sold and bought in order that a certain amount of light shall be reflected into our eyes from objects which must be viewed under artificial light; but lamps and mantles emit light in all directions, and users ought to understand that a large proportion of light which falls upon walls and ceilings of poor reflecting capacity is absorbed permanently, and represents money thrown away without any result. It is also in the best interests of those who sell illuminating energy, or the means by which it is utilized, to be in a position to point out to their customers that buying light in order to feed with that expensive commodity the capacious appetite of (say) dark red or olive green papers, is hardly conducive to satisfactory results. There is a need for recognized standards of surface brightness which will be satisfactory for different classes of interiors; and the author ventures to suggest that the Council of the Society should take steps to establish such standards.

The predetermination of interior illumination is at first sight by no means an easy problem. The proportion of light thrown upon walls, table, and floor is subject to variation with every alteration of shade and height of lamp. Then the ceiling reflects not only on to the table and floor, but also on to the walls. They, in turn, reflect partly on to the floor and partly back to the ceiling; and all these incidents of reflected light are reflected again and again until the mind refuses to grasp further complications. But however complicated reflection may be, its total effect at any point can be ascertained by simply screening off any direct rays previously incident on that point from the light source. If such results were obtained, averaged, and recorded for a sufficiently large number of interiors and conditions, there would be little difficulty in determining, at least approximately, what reflected illumination might be expected from any given flux of direct light on walls and ceilings of different colours and textures. If for any situation the direct flux were calculated from the candle-power distribution curve, the indirect or reflected flux deduced from results obtained under similar conditions, and the surface brightness of the wall surfaces ascertained by multiplying the flux direct and indirect incident upon them by the coefficient of reflection of their colour and texture, then the essential conditions of interior lighting could be satisfactorily predetermined.

The author proceeded to discuss the question of reflection coefficients, and then candle-power distribution curves. Candle-power curves of lamps and shades are, he says, not used at the present time to anything like the extent which they ought to be, and to which they would be were it possible for the lighting expert to obtain them readily for any combination of lamp and shade. If it were possible to secure a fully accurate curve from a lamp and shade either in actual use or fixed temporarily to a point, doubtless they would both be employed more largely. The author suggests a method as being simple and sufficiently accurate for practical purposes. To one end of a light wood lath is fixed a vertical bent plate of tin, blackened and marked in degrees, and carrying a plumb bob, so that the angle with the horizon at which the rod is being held can be at once read off. Part of the tin plate is bent at right angles to the direction of the lath, and a plate of known whiteness—white blotting paper or a "Lumeter" test-plate—is attached by means of a rubber band. A blackened brown paper screen is held or hung behind the lamp and shade to be tested; and the lath is held with the point just touching the lamp. The illumination in foot-candles produced on the test-plate is then read, with the lath held at different angles. This illumination (except in a blackened room) is produced partly by the lamp and partly by reflection from surroundings, or even by other lamps. The rays coming from the lamp alone are isolated from the extraneous light by a small black screen, of such a size as to just screen all the rays from the lamp and shade (but nothing else), held in a notch in the lath; and a reading taken under these conditions represents the extraneous light only. The difference between the two represents the direct rays from the lamp and shade only. The net foot-candle readings divided by the square of the length of the lath used gives the required candle power at various angles. The method seems somewhat rough, but it is very handy, and gives curves which approximate very closely to those obtained in the laboratory. What the installing engineer requires to know is what increase in the flux will be due to reflection.

Describing his tests of the effects of wall papers in a given interior, the author said that, as far as his results have been carried, it would appear that, under average conditions, the increase of flux of illumination on walls by reflection tends to vary somewhere from between 50 per cent. and 70 per cent. with white wall paper down to between 20 per cent. and 30 per cent. with very dark papers. The increase of flux of illumination on white ceilings appears to be in about the same proportion as on the wall papers to which they are adjacent. The increased illumination in table planes in foot-candles appears to be about a mean between the increases in foot-candles of the flux on the walls and ceiling.

Discussion on the Two Papers.

The discussion was somewhat discursive, and, as it does not lend itself to much compression, we must ignore the greater part of it. It was felt by Mr. A. P. Trotter (among others) that the papers deserved special study before being discussed. The vast importance of room decorations upon the illumination was emphasized by him; and he thought that architects required to be educated up to essentials. He agreed, too, that there is much to be learned about this matter; and he thought that Mr. Waldram is the man to carry on an investigation into the subject—on the same lines that he commenced some years ago, by constructing models of rooms to scale, and getting light into them. Such a model could be internally decorated and papered in different ways, and a ½-candle lamp could be put into it, and the illumination effects noted, together with the reflective and absorptive power of the papers. Mr. Justus Eck found great value in Mr. Harrison's paper; and said it was very important that men engaged in illumination should get well into their minds the difference between light and illumination. There were, he pointed out, dreadful examples of light-giving devices, which were apparently intended to impress people with the light given off from their surface and not by their illumination. There were, of course, better methods of ascertaining the value of a light than by looking at the outside of the lamp. He thanked Mr. Haydn Harrison for the list of terms and definitions given in his paper. It was, in his opinion, very important that those engaged in illumination should use terms that would distinguish secondary illumination from the light of the primary source. Personally, he favoured the adoption of "luminosity" as the secondary illumination. As to the suggestion regarding makers supplying polar curves showing the nature of the light from their lamps in different directions, he admitted that it was a good idea; but it was not one that would appeal to all manufacturers, owing to the misuse that was made of such curves by trade competitors. At the same time, he felt sure that there would be response to any serious request from any illuminating engineer for a polar curve. Mr. V. H. Mackinney criticized various points in Mr. Harrison's paper. Among others, the author had stated that reflectors and globes enhanced in one way the value of a lamp—enhanced the direct illumination given by a lamp; but he held that properly constructed globes and reflectors enhanced the value of the light also in other respects—especially in relation to the effects upon the eye. Regard had been had to this point in the design of Holophane globes and

reflectors. He then dealt at some length with experiments that had been made on wall papers of different colours; but without the table of results from which he quoted, the remarks would not be altogether intelligible.

Mr. Ritchie bore testimony to the reliability of the Holophane "Lumeter" photometer. He had had an opportunity lately of comparing it with five others, and it came out second, and stood upon a very high plane. Mr. Harrison had asserted that shadowless illumination was always depressing. Personally, he did not know of any system of illumination which could correctly be described as shadowless, though he agreed that really shadowless illumination would be very unhappy. This, however, was a point that required close study and agreement between illuminating engineers and decorative artists. He was in accord with Mr. Waldram as to the desirability of indirect illumination; and, in this connection, he pointed out that, though he had made an exhaustive research into the work done by the Society, he had only been able to find two instances in which any specific installations of indirect lighting had been condemned. One of these was a case in which Professor Morris admitted that no scientific reflector was used under an arc lamp, and the position of the lamp was determined by headway rather than by scientific considerations. There was also an instance by Dr. Bishop Harman of an installation at Cambridge, which was fitted up a number of years ago, and referred to an alternating system. In this particular case the lamps were required for dissecting purposes, which was an altogether novel feature.

The next speaker was Mr. J. G. Clark, who said he noted that both Mr. Harrison and Mr. Waldram were in favour of a complete distribution curve to represent the true value of a lamp. He (Mr. Clark) had advocated this method for a long time, and felt sure that a curve was of much greater practical value than data obtained by the integrating methods. An extensive adoption of a system of curves would also encourage lamp manufacturers to apply scientific methods to the design of their shades, &c. He was pleased to read Mr. Waldram's remarks in regard to the illumination of the upper parts of a room. Of course, where any architectural or colour scheme existed, its illumination should be seriously considered. His own observations led him to believe that a comparatively low illumination was sufficient for this purpose, as, for instance, that which was due to the light transmitted through a Holophane or opal shade. In regard to the illumination of the walls of rooms of various sizes, it occurred to him that, for a given form of room, and a given scheme of decoration, the illumination of the walls produced by light units of a given power would be approximately inversely proportional to the square of the linear dimensions. If this proved to be fairly true, it would form a very simple rule.

Mr. W. R. Rawlings and Mr. John Hewett also spoke. The latter emphasized the importance of illuminating engineers paying special attention to the question of avoiding eye strain, and of carrying out their schemes so that there was avoidance of any sudden transit from darkness into light. Mr. Harrison and Mr. Waldram replied to the discussion. Regarding the suggestion by Mr. Trotter, the latter said he had come to the conclusion that small models of rooms—say, 10 feet square—could not be considered comparable with rooms 100 feet square.

MIDLAND JUNIOR GAS ASSOCIATION.

Sixth Annual Meeting.

The Sixth Annual General Meeting of the Midland Junior Gas Engineering Association was held last Thursday evening, at the Birmingham Municipal Technical School—Mr. R. S. Ramsden (Burton-on-Trent), the President, in the chair.

Report and Balance-Sheet.

The Hon. Secretary and Treasurer (Mr. G. C. Pearson) read the report of the Council and the balance-sheet. The former stated that the Council congratulated the members upon another most successful session. The number of members was 160; the roll being greater than for any previous session. It was noted with gratification that there was no lack of useful and excellent papers to lay before the Association; and the papers thoroughly maintained the high standard set in previous sessions. The Association were indebted to the President for his able address, and to readers of papers. The programme for the session had been thoroughly comprehensive; and the visits had been most instructive and enjoyable. An additional visit was arranged to the Adderley Street Gas-Works in the evening, with great success. Many thanks were due to the various controllers of undertakings for their kind invitations and hospitality; and the Council again desired to express their indebtedness to the Committee of the Birmingham Municipal Technical School for continuing to grant the use of a room for the general meetings. An innovation made during the session—namely, the holding of "Coffee Meetings"—had been attended with the greatest success; having provided larger opportunities for social intercourse and informal discussion. The Council much regretted the deficiency shown in the balance-sheet, which was due, firstly, to the apathetic manner in which the "Transactions" had been taken up this session, and, secondly, to the much increased cost of printing consequent on the greater length of the papers and to a heavier outlay on postage. The Council were arranging a joint meeting of Junior Associations to be held in Birmingham on May 13. The report then enumerated the advancement secured by members of the Association during the past session; and it concluded as follows: "The Council trust that the enthusiasm and interest of the members, which has been so well maintained up to the present, will continue, and assist the Association in holding its present high position in the gas world." The accounts showed an excess of expenditure over income of £8 9s. 8d.; and after deducting this from the balance in hand, there is carried forward £25 8s.

Mr. P. C. Balcon (Birmingham), in moving the adoption of the report and accounts, said it was a matter of regret that the funds showed a decrease; but the gain from the increased length of the papers greatly outbalanced the deficit.

Mr. W. J. Pickering (Birmingham) seconded the motion; and it was carried unanimously.

Alteration of Rules.

The Hon. Secretary said the following altered rules were submitted by the Council: Rule I.—"The Association shall be called the Midland Junior Gas Association." Rule VII.—"The business of the Association shall be conducted by a Council, consisting of a President, two Vice-Presidents, Hon. Secretary, Hon. Treasurer, and six other members, two of whom shall retire each year and be ineligible for re-election during the following year. In the event of a member being elected to fill a special vacancy on the Council, this member shall be eligible for re-election. The Junior Vice-President shall be selected from Birmingham and district members alternately; the Secretary and Treasurer shall be Birmingham members; and the Council shall consist of four district members and two Birmingham members. The Council shall elect by ballot the Junior Vice-President." He explained that the reason for suggesting the alteration of Rule VII. was that the business of the Association should always be conducted by a Council that was fully representative of the Association. Up to the present, it had been an unwritten rule that district members and Birmingham members should be alternately elected; but as the membership grew, it was becoming more difficult to apply this rule without it being put down in black and white. Selecting the Secretary and Treasurer from Birmingham men meant that the business was able to be carried on much better; and the four district members of the Council made up for this. It seemed to the Council much better that the Vice-President should not be subject to election by the general meeting. It was the post that conferred the greatest honour the Association could bestow upon any one of the members; and as the Council elected in the manner set forth would be so thoroughly representative of the Association, it appeared desirable that they should select by ballot the Junior Vice-President each session.

The President proposed the alteration of Rule VII.; and remarked that it reflected credit on the original draughtsmen that the rules had required so little modification during the six years' life of the Association.

Mr. F. J. Ward (Knowle) seconded; and the proposition was agreed to.

Mr. Ward, in moving the alteration of Rule I., said it seemed to him that the Association had always been misnamed, because it was not composed of engineering members solely. A shorter name would also be an advantage.

The President seconded, remarking that it was proceeding on the lines of broadening the basis of work of the Association in the direction pointed out by Mr. J. W. Helps in his Inaugural Address to the Institution of Gas Engineers last year.

The proposal was carried.

Election of Officers.

The following officers were elected for next session:—
President.—Mr. R. J. Rogers (Birmingham).
Senior Vice-President.—Mr. W. S. Smart (Saltley).
Junior Vice-President.—Mr. F. Shewring (Droitwich).
Hon. Secretary.—Mr. W. J. Pickering (Birmingham).
Hon. Treasurer.—Mr. G. C. Pearson (Birmingham).
New Members of Council.—Mr. P. C. Balcon (Birmingham), Mr. A. Hancox (Great Malvern), and Mr. B. Skidmore (Smethwick).

The Birmingham Coal-Test Plant.

Dr. W. B. Davidson, the Chief Chemist to the Birmingham Corporation Gas Department, then summarized a lengthy paper which had been prepared by him and Mr. G. C. Pearson, on the "Birmingham Coal-Test Plant." This paper, with a report of the discussion on it, will be found on pp. 308-14.

Mr. W. H. Johns (Saltley) proposed a hearty vote of thanks to the authors for the valuable information they had given the members. He remarked that Dr. Davidson, as the majority of those present were aware, had recently read a similar paper—of course, going into greater detail—before the Institution of Gas Engineers; and for this paper he had been awarded the gold medal, which was the greatest honour that could be conferred upon anyone in the gas industry. (Applause.) They, as an Association, should therefore feel—and he knew they did feel—that very many thanks were due to him for coming and giving them further information as to the test plant. At the majority of gas-works nowadays, it was necessary to have a coal-test plant; but, of course, they were not all in a position to run it on so large a scale as Birmingham, and the results obtained could not therefore be compared with

those at this city. Thus the information given with reference to the Birmingham plant was of very great use, not only to their Association, but to those engaged in the gas industry throughout Great Britain—in fact, throughout the world. It was most useful to know what could be secured from the coal, and to obtain a check on the supply of coal from the collieries. At one works where he had been engaged, they made a practice of testing the coal periodically. They could not run the plant every day; but from time to time tests were made and records kept of the make per ton, candle power, calorific value, and impurities. Of course, all residuals were taken into account and their value scheduled. When the time for making coal contracts came round, this enabled them to select the coal which would be most suitable for their use, not only from a gas-making point of view, but also looking at the ultimate result. This meant that they bought the coal which gave them the best financial results on the twelve months' working. Therefore a test plant was very desirable in connection with a gas-works.

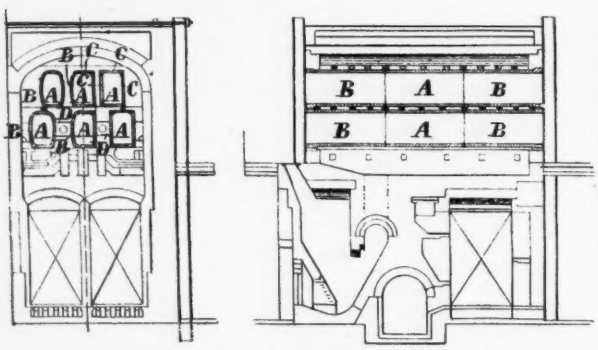
Mr. W. S. SMART (Saltley), in seconding, pointed out that the paper had been prepared under anything but ideal conditions, as Dr. Davidson had been away and Mr. Pearson had been exceedingly busy. Under these circumstances, had the authors not had the welfare of the Association so much at heart, they might have failed the members at a critical time.

The vote was carried with applause.

Dr. DAVIDSON returned thanks on behalf of himself and Mr. Pearson, and said they had been agreeably surprised that the members had not severely criticized it, because it had been got together in a great hurry.

MUFFLE RETORTS FOR GAS MAKING.

The increased employment of retort charging and drawing machinery in the manufacture of gas causes an ever-growing tendency to carbonize larger quantities of coal and submit them to longer periods of distillation. As the existing arrangement and dimensions of retort-settings are not suitable for this, and as it is not always convenient to alter them, a system has been devised by MM. Ernest Hovine and Raoul Frère, by means of which average weights of coal can be allowed to remain in the retort much longer than hitherto. Very little alteration is necessary in ordinary settings of longitudinal retorts, in their dimensions, or in the method of stoking them; and their productive capacity is unaffected. The device, which is shown in the accompanying diagrams (transverse vertical and longitudinal sections respectively), has been patented by the Société d'Eclairage, Chauffage, et Force Motrice, the owners of the gas-works at Gennevilliers, near Paris, which were described in the "JOURNAL" last July, in connection with the visit of the members of the Société Technique du Gaz. Of these works one of the inventors (M. Frère) is the Resident Manager.



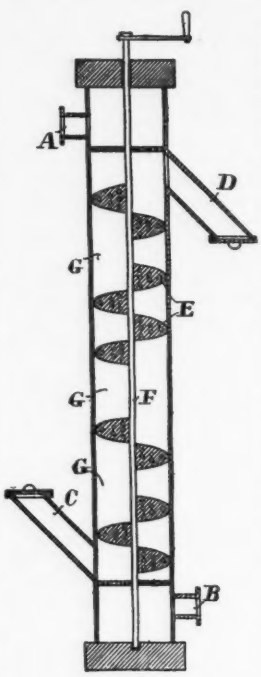
In an ordinary setting of nine 20-feet retorts, heated on the regenerative system, there are two rows of nostrils, and the retorts are charged with a layer of coal from 4 to 8 inches thick, which is worked off in from six to eight hours. In order to adapt such a setting for prolonged distillation, it is furnished with six horizontal muffles, which may be made of the shape shown at A and B in the diagrams, or else of fire-clay tiles, as at C, suitably placed together, as shown in the right-hand side of fig. 1. The annular sections B and the tiles are cross-braced from one muffle to the other or to the setting itself by transverse walls D. These muffles are charged with coal until they are quite full, and it is left there for twelve or fifteen hours, so as to yield in twenty-four hours the same quantity of gas as that obtained with existing arrangements. The number and dimensions of the muffles may, of course, vary with the length of charge and the quantity of gas required to be produced.

Scottish Junior Gas Association (Eastern District).—We have received the "Transactions" of the Eastern District Section of the above-named Association for the session 1910-11. The pamphlet contains the papers and discussions at the various meetings, reprinted from the "JOURNAL," together with the annual report of the Council, lists of officers and members, a catalogue of the library, and the accounts. A portrait of the President (Mr. Walter Dunlop, of Kirkcaldy) is given as a frontispiece.

GAS-PURIFIER WITH CONTINUOUS ACTION.

For the removal of the sulphur from gas, upright purifiers have already been constructed in which the purifying material is generally introduced at the top and is carried towards the bottom in chambers of columnar form by bucket-chains, endless screws, or other appliances, while the crude gas passes through the purifier in an opposite direction to that of the purifying material. A purifier of this kind has been devised by Herr Heinrich Raupp, who has taken out a patent for it for France; and the following particulars are translated from the specification.

It will be seen from the accompanying diagram that the purifier consists of a fairly high cylindrical box, provided at top and bottom with pipes A B; the upper one being used preferably for the admission, and the lower one for the exit, of the gas. The purifying material is put in at the bottom of the purifier and comes out at the top. For this purpose there are two pipes C D, arranged at angles as shown. A series of screw-blades E, upon the shaft F, which is movable by the handle at the top, raise the purifying material. These blades, which are made of perforated sheet iron, are not continuous, as will be noticed, but are placed as shown at G.



The action of the purifier is as follows: The purifying material is introduced through the pipe C, and at the same time the screw E is turned in order to raise the material, which, owing to the arrangement of the blades, is deposited in layers of greater or less thickness. By this means, the gas is forced to pass through the material. When the purifier is full, the pipes C and D are tightly closed, and purification of the gas can begin without any turning of the screw being required. In order to remove the spent material, the two pipes are opened, and fresh material is introduced through the pipe C; the screw being at the same time turned so that the material in excess is forced out through the pipe D. As soon as this takes place, the charging of the purifier has been completed, and the vessel is filled with fresh material. It is preferred, in practice, to cease charging before the whole of the spent material has been expelled, so that the gas entering by the pipe A has to pass through it, as the chemical action involved in purification is performed better than if the gas has to go through fresh material only.

Klonne Chamber Settings at Padua.

In the "JOURNAL" for the 18th ult. (p. 169), reference was made to the above-named settings in the early part of the paper read by Mr. Joseph C. Markley, of Chicago, before the Illinois Gas Association; and the results of some trial tests were given by M. Parsy in the paper submitted by him to the Société Technique du Gaz en France last year, as recorded in our columns at the time. The following figures, taken from "Der Ingenieur" for March 15, show the saving effected during 1910, as compared with 1909, working under similar conditions:—

	1909.		1910.	Difference.
Coal gasified . . . tons	9,065	..	8,082	.. −983
Gas generated . cubic metres	2,616,605	..	2,640,050	.. +23,445
Firing of furnace . . tons	1,825	..	1,406	.. −419
Sulphate of ammonia . kilos.	49,700	..	60,985	.. +11,285
Wages and salaries . marks	68,369	..	42,887	.. −25,482
Expense for electric current .	—	..	1,669	.. +1,669

Southern District Association of Gas Engineers and Managers.—On the invitation of the Chairman and Directors of the Winchester Water and Gas Company and their Engineer and General Manager, Mr. H. C. Head, the President of the Association, the spring excursion meeting will be held at Winchester on Thursday. The programme issued by the Hon. Secretary (Mr. W. E. Price, of Hampton Wick) includes visits to the Andover Road gasholder station, the Winnall Gas-Works, the Cathedral, and, if there is time, the College. The members will be entertained at luncheon at the Royal Hotel by the Water and Gas Company.

American Association for Conservation of Vision.—The "Illuminating Engineer" of New York for the present month contains particulars of an organization formed under the above title for initiating a national movement for the prevention of blindness, and safeguarding the eyes of the people. The general field of work is divided into six departments, each having a director and staff of associates, with sub-committees; and the whole question of light and illumination, in the industries, in schools, and in the homes, will have its due share of consideration. The President is Dr. F. Park Lewis, of Buffalo; and the Vice-President is Mr. E. Leavenworth Elliott, the Editor of the publication named.

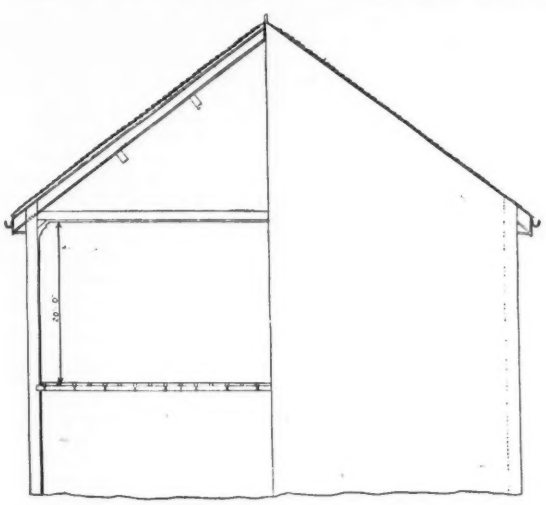
HEATING FLUELESS ROOMS.

By J. H. Brearley, of Longwood.

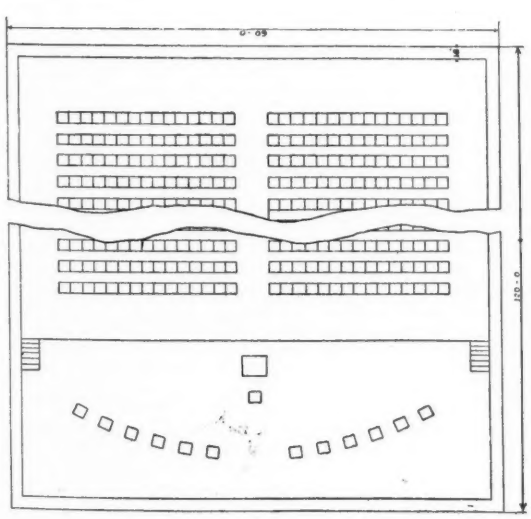
[A Paper read before the Eastern Counties Gas Managers' Association. April 28.]

Only of recent years has gas seriously entered the lists as an agent for heating large public buildings. The practicability of heating such buildings by hot-water pipes and radiators supplied from gas circulators is a recent development of this class of heating. [A more recent method is to utilize radiators connected to gas-heated boilers for heating air before it is admitted to the room or rooms to be heated. To this system reference is made later.] Attempts were previously made, with varying degrees of success, to popularize flueless gas-heaters. Such efforts were not made easier by the confusion of patterns, embracing luminous or non-luminous flames, condensing or non-condensing tubes, steam or steamless tubes, iron frets, fire-clay fuel, and copper reflectors. There were square stoves, circular stoves, and oblong stoves; stoves with visible, others with invisible flames; and altogether sufficient types and cross types to make the task of selection one of bewildering perplexity. The advertisement of one maker in a technical journal would have quickly settled the matter had it not been for the unfortunate (?), but not less convincing, claims set up by another maker two pages further on.

The author suggests that when next a gas exhibition is held the history of gas-heaters be "written" by actual specimens dating back to the earliest application of the system. Such an exhibit will be not only interesting, but educational; and since the makers are all pioneers (*vide* advertisements), they would doubtless readily co-operate to make it a complete one. The only fear is that from his own archives each maker will produce as original designs everything that has been successfully employed for gaseous heating. If this be so, the ordinary gas manager must decide for himself which were the productions that came over with William the Conqueror and which did not appear till the days of Cromwell. Perhaps, too, the same perspicacious exercise will enable him to determine which maker is entitled to write the ninth letter of the alphabet with the largest capital.



Section. Elevation.



Plan.

Public Hall—144,000 Cubic Feet Capacity—to Seat 1000 Persons.

Self-contained flueless heaters are so varied in design and type as to furnish a sufficient reason for the indifference to them of many distributing engineers, apart altogether from the merits or demerits of flueless heaters as a class. The writer is conservative enough to think that this indifference has been a good thing for the gas industry. All heaters should pass the test of "Is it good for the user," rather than "Will it bring profit to the gas undertaking." When a gas-fire is placed under a flue that is too large for it, it may not be economical; but hygienic conditions at least are usually ensured if, when fixing, proper attention is given to promoting draught. When there are no flues at all, however, too much caution cannot be exercised as to the correct appliance to be employed. Our industry must always see to it that its character for supplying an agent that is hygienically safe both for lighting and heating cannot be successfully impugned.

Whether in an acceptable form or not, the whole of the heat of combustion from flueless heaters is discharged into the room in which such appliances are fixed. The boiler of a hot-water circulating system is fixed, as a rule, outside the room or rooms to be heated; and consequently the actual heat which reaches the rooms is the total generated less the amount which passes up the flue of the boiler, and possibly a fractional amount lost in radiation between the boiler and the heated rooms. Both the boiler and the leading pipes should be insulated. Under such conditions, the effective heat will be not less than 95 per cent. of the total. [The term effective is here used to denote the heat which is actually conveyed to the rooms being heated.] At a cost of 5 per cent. of the total heat, therefore, the whole of the products of combustion are kept out of such rooms. This is calculated on the net heating value as determined by a calorimeter. As you are all aware, the amount of latent heat contained in the steam which is generated by the combustion of coal gas varies according to the hydrogen contained in a free or combined state, and is usually about 10 per cent.; this being the difference between what are expressed as gross and net calorific values. The steam formed by gas consumption in circulating boilers is condensed after the products have passed through the circulator, and is therefore not transferred to the water, though some condensation takes place in the flue of the circulator during the process of heating up.

It is necessary that the products passing through a circulator shall be at as great a temperature as the water, in order to avoid condensation in the waste-gas travels. That 5 per cent. of the loss is sufficient for this will readily be seen by taking, as an example, a circulator consuming 60 cubic feet of gas per hour, 5 per cent. of which is 3 cubic feet. The heat units in 3 cubic feet are sufficient to heat up 810 cubic feet of air 100° Fahr., or 405 cubic feet of air 200° Fahr. With a well-designed circulator and flue connections, this quantity is ample to retain steam in suspension.

It is only during the last two or three years that the application of hot-water circulating systems in which town gas provides the energy has been demonstrated to be practicable. Here a promising field for gas utilization has been opened out. It may not be out of place, therefore, to get back to first principles, and see how far this system may reasonably hope to prosper. The writer, therefore, has taken for illustration a hypothetical hall shown in the simple sketch, and the particulars of which are given in Appendix A.

One cubic foot of gas of 513 B.Th.U. net will heat 2·160 lbs.—*i.e.*, 27,000 cubic feet—of dry air from 40° to 41° Fahr. This hall, therefore, will require 5·33 cubic feet of such gas for each degree Fahr. that the temperature of the air is to be raised, each time the air contents are changed. As is shown in considering temperatures (Appendix B), it may be necessary in the coldest weather to put 30° Fahr. into the air of the room, in one way or another, to make it comfortable. Assuming the rate of air change to be eight times in the hour (Appendix D), a full audience of 1000 persons can be relied upon to raise the temperature by an average of 14° Fahr. (Appendix E).

There are, however, two other factors which can only be decided according to the class of structure and the method of ventilation employed—viz. (1) loss by conduction; (2), with the natural system of ventilation the temperature at the breathing level will always be less than at any higher level. From the data given in Appendix A, we are enabled to get an approximate estimate of losses by conduction through the floor, walls, and ceiling, with the form of construction there given. Whereas the calorific value of an audience of 1000 persons is equivalent to 660 cubic feet of gas (Appendix E), the losses by conduction, even with the extreme variation of 30° Fahr. between inside and outside temperatures, are only equivalent to 360 cubic feet of gas (Appendix A). So that if we set the calorific value of the audience against conduction losses and difference in degrees temperature of levels above the breathing height, we shall not only simplify matters but approximate to accuracy. The 300 cubic feet difference between the calorific value of the audience and the conduction losses would be sufficient to maintain the temperature of the top half of the room at an average of nearly 15° Fahr. higher than the bottom half, with an air change of eight times in the hour.

To comply with the standard of purity required (Appendix D), the air must be changed eight times, and the temperature raised 30° at the coldest periods of the year. This will require: $5{\cdot}33 \times 8 \times 30 = 1380$ cubic feet of gas per hour for heating with an outside circulating boiler.

Now comes the problem! Is the gas to be consumed *in* or *out*

of the room? The quantity of carbonic acid produced by gas when consumed varies according to the carbon compounds present; but we may assume an average figure of 0·55 cubic foot for each cubic foot of gas. Upon this basis, 1380 cubic feet of gas will produce 759 cubic feet of carbonic acid. On a rate of air change of eight times in the hour, this is equal to 6·6 parts in 10,000. But it has been demonstrated (Appendix D) that the air must be changed eight times in the hour to keep down the carbonic acid content to 12 parts per 10,000 when taking account of the carbonic acid produced by the audience alone.

It is clear, then, that if gas consumption is to be allowed inside the room, as would be the case with flueless heaters, the rate of air change must be increased to keep within such a standard of ventilation as the Departmental Committee specified for the ventilation of factories. This, in turn, would mean more gas consumption to keep the temperature of the room up to an agreeable degree. The increased gas consumption would generate further carbonic acid, and so on. With a system of heating by a gas-heated hot-water circulator, there is only one point to adjust when modification in temperature is required; whereas with flueless gas-radiators, there would be the gas consumption to regulate at several points.

While upon this phase of the subject, attention may be called to the following statement recently made by one of the principals of a leading firm of makers, when referring to gas-heated radiators:

> The products of combustion, being warmer than the surrounding air, immediately ascend to the upper part of the room, where the carbonic acid either directly escapes by diffusion, owing to the porosity of the walls and ceiling, or else mingles with the air in the upper part of the room and eventually escapes in the ordinary way without descending to the breathing level. Once the carbonic acid has mingled with the upper stratum of air, the mixture becomes a perfect one.

This is an unfortunate description of what happens with regard to the combustion of gas by means of a radiator, whether it is heated internally or externally. In the type of radiator where combustion takes place outside the tubes (even if the flames are properly adjusted), the products impinge upon the bottom of each tube and wrap round it in ascending. If any air is heated by the tubes—which, of course, is obviously the case—it must mix with the envelope of products, for diverting which in a stream no special provision is made. The arrangement of the case which protects the flame from draughts is so shaped to the pipes that the products must pass between the case and the pipes, where there is thorough mixing with air, and no subsequent unmixing can take place.

In the type of radiator where combustion takes place inside a tube, quantities of air join the products inside the tubes, and diffusion of products and air may be said to commence immediately after combustion. The relative velocities of diffusion of any two gases are inversely as the square roots of their densities, the operation of which law is greatly in favour of the hygiene of gas, since carbonic acid, whether it is inert or not, diffuses in air so rapidly as to be quite harmless under all normal conditions of use. Where heating by convection is done, the whole of the upper space in a room must be filled with warmer air before the heating can be effected at the floor-level. It will never do to claim that the products have a happy way of going "single file," as it were, to the highest point of exit, or that in their eagerness to evacuate they have a special prerogative for diffusing through walls that is denied to the components of air—nitrogen and oxygen. The products, as stated, diffuse freely; and though the percentage will undoubtedly be higher in the upper parts of the room, because of the higher temperature of the air, nevertheless the composition of the air at the breathing level will be affected according to the system and degree of ventilation in operation.

From what has already been said, it would appear to be demonstrated without question that all flueless rooms in which are considerable numbers of people should be externally heated, if regard is shown for economy. It is not part of the writer's mission to insinuate, nor does it coincide with his observations, that hygiene cannot be maintained with flueless radiators, but simply that it is not the most economical form of heating by gas. By means of circulating water-heaters, and with a primary sacrifice of not more than 5 per cent. of the heat units, the whole of the products can be kept outside the room to be heated; and the larger secondary sacrifice by ventilation, as with flueless heaters, is avoided.

Certain records of temperatures at Huddersfield in 1910 are given in Appendix B. In making observations upon the heating of public buildings, the minimum and maximum temperatures recorded for one day only are of little value, as the lowest temperature in one year may stand as a record for several years. So, too, with the highest temperature. The mean temperature for the minimum week was 31·3° Fahr., and the mean temperature for the maximum week was 62·1°. These figures give a broad indication of the extremes to be dealt with when considering heating problems. Apart from the effect of any system of heating, inside temperatures do not fluctuate either to such extremes or so rapidly as outside; the degree of fluctuation being affected by the rate of ventilation, and the conductivity of the walls, windows, &c., which form the structure.

The air space per adult in the hall we have taken is 144 cubic feet; and as the minimum space per person required in factories and workshops is 250 cubic feet where people are actively engaged, this proportion of 144 cubic feet for a public hall is permissible. Indeed, it often works out in actual practice at less; and if any penalties are incurred, they do not appear to be ever enforced. [With regard to the standard of air purity, it may here be said that whatever standard is necessary for workshops should be enforced for meeting halls and the like.]

A great advantage with the use of gas is that the installation can be shut down when not required, and superfluous heating, as is the case with boilers fired with coke and other fuels, is avoided. For continuous heating, no gas engineer will contend that gas can compete economically with coke-fired installations, but where the heating is intermittent the prospects rapidly increase as the intermittency increases.

In Appendix G is given a comparison of the effective heat available from coke and gas respectively—taking the cost of the former at 14s. 2d. per ton, and of the latter at 2s. per 1000 cubic feet. For fuel costs on this basis, coke is only one-fifth that of gas. When one leaves fuel, however, the advantages are all in favour of the gas-heated system. The first cost of installation is less, the attendance is almost *nil*, and there are no clinkers and ashes to remove. The heating is more regular and is easier of adjustment. The apparatus begins to be effective almost from the moment the gas is lighted; whereas with coke-fired installations, a longer period elapses.

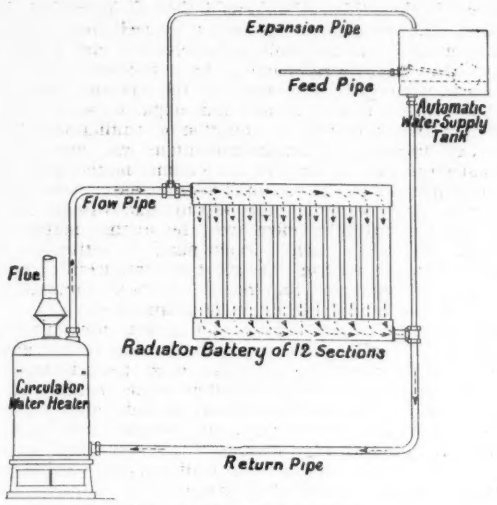
It is usual to fire coke-boilers twice a day—once in the early morning and again in the evening. With such irregular methods of firing, it is no uncommon thing to find that the greatest amount of heat is being generated when it is least required, and *vice versâ*. Take, for example, a block of offices. The fire is filled up in the early evening, and from midnight until the following morning the heat contained in the water is a greatly diminishing quantity. In the early morning, the fire is clinkered and filled up; but as a rule a reasonable temperature is not obtained until the office has been occupied for an hour or more. For intermittent heating, therefore, the coke-fire apparatus represents a considerable loss both in lighting-up and letting-down. Wherever a hall is subject to casual letting, a gas-heated hot water or air system should be a strong competitor with coke.

It is not possible to make a general comparison in these circumstances. Each one must be judged upon its merits according to the local price of gas and coke, and according to the conditions governing the use of the hall. A building of such dimensions as we have taken, if heated by gas for four hours upon each day in the year when the mean temperatures for the week averaged less than 50°, and when the temperature required in the building was 60°, would require about 660,000 cubic feet of gas, or a cost of £66, with gas at 2s. per 1000 cubic feet (Appendix C)

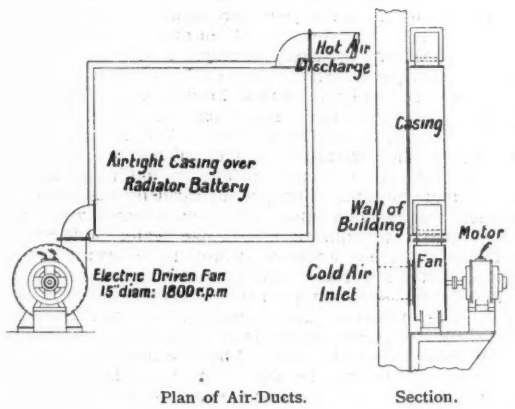
The heating of large rooms is almost invariably done by convection. A flueless gas-radiator will give up to 20 per cent. of its heat in the form of radiation; but even this small proportion is rapidly converted into heat of convection after being absorbed by the walls, floor, or solid objects of the room. The root principle of all large heating installations being, then, warm air, does not the best practice of all appear to be warming the air before it enters the room? Such a system was installed last year at the premises of the Society of Medical Officers of Health, and was described in the "Journal of Gas Lighting" for Oct. 18 last. The room so heated has a capacity of 7500 cubic feet. The boilers are three in number, and when at maximum consume together 240 cubic feet of gas. From these, hot water is supplied to two batteries of radiators, which have been fixed in hollow spaces between three outer windows of the building. Here air is caused to pass over the radiators; the necessary induction being obtained by a 2-feet fan. The heated air is admitted to the rooms through narrow slits in a duct running outside the casement at the ceiling level. A consumption of 240 cubic feet of gas will raise the temperature of 200,000 cubic feet of air 30° Fahr.; and it appears improbable that this installation will be called upon to operate at full capacity, except for short periods when quick heating up is required.

Quick heating is essential to economy in such an installation as this, for hot air cannot be admitted to the room unless a corresponding volume of cold air is ejected; and to carry on the induction and ejection over prolonged periods when the rooms are not in use would be avoidable waste of heat energy. Similarly, buildings heated with hot-water pipes or radiators installed in the rooms being heated are more economically heated if proper attention is given to the opening and closing of the ventilator. If the air of a room has acquired the temperature required before being brought into use, the air outlets should be closed, and the heating apparatus reduced to the minimum point necessary for maintaining such conditions. Even if the usual ventilation outlets are closed, there will be a certain quantity of heated air dissipated by diffusion through the walls, the ceilings, &c., and some heating will be necessary to make up for this. Then, when the rooms are occupied, the ventilation should be regulated to the required degree, and the supply of heated air augmented accordingly.

Another installation of a similar character was recently completed at the Dalston Theatre. The arrangement is shown on the drawing, p. 297. In this instance, a Wilson's "Circulator" water-heater is connected to a radiator battery of twelve sections. The radiators are enclosed in a galvanized iron casing; and the radiator loops being placed end to end, the greatest amount of contact between cold air and warm radiators is secured. In this installation, the amount of air passed through the galvanized casing is 2000 cubic feet per minute, the temperature of which is raised approximately from 40° to 170° Fahr. As in the case of the installation previously referred to, the induction of air is obtained



Plan Showing Flow of Water.



Heating Arrangement at the Dalston Theatre.

by an electrically driven fan. The "flexibility" of this method of raising the temperature of public halls and the like should attract greater attention to it.

APPENDIX A.

PARTICULARS OF HALL.

Length, 120 feet. Width, 60 feet. Height, 20 feet.

Seating accommodation for 1000 persons.

Floor area, 7200 square feet. Ceiling area, 7200 square feet.

Area of wall surface, 6000 square feet. Area of windows, 1200 square feet.

Coefficient of transmission:

Floor, 7 inches of concrete, covered with 1¼-inch blocks	0·19
Ceiling, lath and plaster	0·40
Walls, 18-inch brick	0·23
Windows, double cased	0·48

Conduction losses for each degree Fahr. difference in temperature:

Floor	1368 B.Th.U.
Ceiling	2880 ,,
Walls	1380 ,,
Windows	576 ,,
Total	6204 ,,

the equivalent of 12 cubic feet of gas, or 360 cubic feet for 30° Fahr. difference between inside and outside temperatures.

APPENDIX B.

TEMPERATURES RECORDED AT HUDDERSFIELD IN 1910.

	Deg. Fahr.
Average minimum daily temperature	41·75
Lowest minimum for one day (Jan. 27)	12·0
Average maximum daily temperature	53·7
Highest maximum for one day (June 7 and 19)	78·0
Lowest average minimum for one week (week ending Feb. 18)	26·2
Average maximum temperatures same week	36·4
Mean temperatures same week	31·3
Highest average minimum for one week (week ending Aug. 16)	54·3
Average maximum same week	69·9
Mean temperatures same week	62·1

APPENDIX C.

Week Ending.	Mean Temp.	Increase Required.	28 Hours' Gas Consumption in Hundreds of Cubic Feet.
	Degrees Fahr.	Degrees Fahr.	
Jan. 4	44·0	16·0	19·1
11	40·2	19·8	23·6
18	39·6	20·4	24·3
25	32·3	27·7	33·3
Feb. 1	31·3	28·7	34·2
8	41·6	18·4	21·9
15	39·6	20·4	24·3
22	41·9	18 1	21·5
Mar. 1	37·6	22·4	26·7
8	44·0	16·0	19·1
15	42·1	17·9	21·3
22	41·5	18·5	22·0
29	43·6	16·4	19·5
Apl. 5	40·2	19·8	23·6
12	43·9	16·1	19·0
19	47·0	13·0	15·5
26	44·2	15·8	18·8
May 3	46·1	13·9	16·5
10	43·1	16·9	20·1
Oct. 18	48·7	11·3	15·5
25	47·8	12·2	14·5
Nov. 1	46·0	14·0	16·0
8	39·8	20·2	24·0
15	39·5	20·5	24·4
22	34·9	25·1	30·0
29	33·8	26·2	31·2
Dec. 6	38·8	21·2	25·2
13	45·6	14·4	17·1
20	45·0	15·0	18·0
27	41·7	18·3	21·8
Total		554·6	662·0

APPENDIX D.

CARBONIC ACID FROM AUDIENCE.

Each person (assuming adults) gives off 0·8 cubic foot of carbonic acid per hour—*i.e.*, 800 cubic feet for 1000 persons.

This works out at 55 parts in 10,000 of the whole room contents, thus:—

$$\frac{800 \times 10{,}000}{144{,}000} = 55$$

The normal quantity in the atmosphere is 3·5 parts in 10,000.

A meeting in the hall would last from one to three hours, with a probable average—as, for example, at a concert—of 2½ hours. The rate of air change should be sufficient to ensure a satisfactory atmosphere at the end of this time.

The limit of impurity allowed or allowable in the atmosphere of buildings was placed at 12 volumes by the Departmental Committee which was appointed to inquire into the ventilation of factories and workshops in 1902.

Assuming the atmosphere to contain 12 parts of carbonic acid at the end of the first hour, it would therefore require changing as follows:—

$$\frac{55 \times 12}{12 - 3{\cdot}5} = 7{\cdot}88 \text{ (say) eight times.}$$

APPENDIX E.

HEAT FROM AUDIENCE.

1000 persons would generate 446,000 B.Th.U. (gross) of heat per hour; but 107,000 of these units would be expended in evaporating water which is given off in the form of moisture. The net calorific value of 1000 adults, therefore, is 339,000 units, or the equivalent of (say) 660 cubic feet of gas. Each adult gives off sufficient heat to raise 141 lbs. of air (1800 cubic feet at 40° Fahr.) 10° Fahr. Actually, therefore, 1000 persons would raise the temperature of the air of the public hall, even if it was changed eight times within the hour, 15·6° Fahr., thus:

144,000 × 8 = 1,152,000 cubic feet.

1000 persons heat 18,000,000 cubic feet of air 1° Fahr., or 1,152,000 cubic feet 15·6° Fahr.

With temperature outside at (say) 44·4° Fahr., the room would require no heating after the first hour, were it not for loss by conduction, and the hygienic necessity of changing the air.

APPENDIX F.

MOISTURE PRODUCED BY AUDIENCE.

1000 persons would give off in the form of moisture 100 lbs. of water, or 700,000 grains.

1 cubic foot of air at 62° Fahr., when fully saturated, contains 6·17 grains. The total quantity given off, therefore, would fully saturate 113·450 cubic feet.

The percentage humidity in the air would depend upon the percentage of saturation to begin with, and upon the number of times the air was changed. If the air was changed seven times—*i.e.*, eight times the volume of the whole room with the air to commence with, and the saturation or humidity was 40 per cent.—the humidity at the end of the first hour would be:—

$$\frac{113{\cdot}450 \times 100}{144{\cdot}000 \times 8} + 40 = 49{\cdot}85 \text{ per cent.,}$$

and so on according to the humidity of the atmosphere.

The walls are nearly always at a lower temperature than the air of the room, and, consequently, condensation begins on the walls and windows before the general air content of the room has reached saturation point, owing to the small portion of air which rubs the wall surface being reduced in temperature till the dew-point is reached. At

50° Fahr., for example, air will only carry as vapour 4·1 grains. If it contains more than this quantity at 62°, and is cooled down by surface contact with walls and windows to 50°, condensation will take place, and the condensed water will deposit on the surface of the cooling media. There will, of course, still be some moisture in the air after contact with the walls. The latent heat is given up when condensation occurs; but as the quantity is variable according to many factors, it is not taken into account.

APPENDIX G.

Comparison of Fuel Costs—Coke and Gas.

Coke.—1 cwt. of coke contains approximately 1,000,000 heat units. With 85 per cent. efficiency in a coke-fired boiler, the effective units will be 850,000. Taking coke at 14s. 2d. per ton, the cost of 100,000 heat units will be 1d.

Gas.—Price of gas, 2s. per 1000 cubic feet. Effective heat units per cubic foot, 487. Number of cubic feet required to give 100,000 heat units, 205; cost, 5d.

Discussion.

The President (Mr. J. W. Auchterlonie, of Cambridge) said he hoped the paper would produce a good discussion, because it was a subject that every gas engineer had to consider at the present time. Much of the information, he was sure, would be useful. He might mention that the Chairman of the Society of British Gas Industries (Mr. James Yates) had had to leave the meeting; but he had informed him (the President) that he had arranged to send his remarks to the "Journal," so that they might be embodied in the report. [They appear on pp. 299–300.]

Mr. James Wilson (Leeds), called upon by the President, said he was sorry it had fallen upon him to say anything on the main subject of the paper. He was afraid he had nothing particular upon which he wished to criticize the paper; but he did think Mr. Brearley would not have made the remarks he had done regarding the manufacturers if there had been more of them there. [Laughter]. The author had been rather severe on the poor manufacturer making the most of his claims. They, as manufacturers, could not expect to rise to the level of the professional man. They were merely traders, and had to lower themselves to the mere traders' level. He thought they were not to be looked upon as exceptional people in this respect. With regard to the principal question in hand, he could not criticize it, because he was entirely in agreement with the author. The firm with which he was connected was one of the few that did not make what were called gas-heated flueless radiators. They had never been in favour of them, solely from the view that Mr. Brearley had expressed. The results he had mentioned agreed with his firm's practice. The view he (Mr. Wilson) held was the one pointed out by the author, that where the burning of gas was not in, but outside, the flueless room, where the heating was wanted, the objections of medical men and others were effectively got rid of. Medical men had a feeling that gas heating by means of flueless radiators was not good; and if gas men could show them that the gas could be used outside the room, and the heat be conveyed into the room, that at once cleared away their objections. In private houses, it was often desirable to heat the entrance halls, and to have supplementary heating in the drawing and dining rooms—something to keep the rooms aired. This could be done by a small consumption of gas under a boiler in (say) the cellar, with a circulator, and pipes running under the floors to radiators put under the windows or anywhere else so as not to interfere with the arrangements of the room. The consumption of gas was only about 1 cubic foot for each loop of the radiator; and so if a ten-loop radiator was put in the entrance hall, it would mean 10 cubic feet an hour. But it would not mean 10 cubic feet per hour the whole day long. In drawing-rooms, they could have a shallow radiator fitted under the window with a window-seat fixed over it; and such an arrangement would keep the room well aired. In large rooms, people often said, "A gas-fire is all very well, but it does not make the other end of the room very warm." But if a system of airing rooms by hot-water radiators was introduced, it would be very popular in a great many houses, and would lead to a good consumption of gas. This, again, would lead to the introduction of gas-fires in rooms where people did not at the present time use them. Some present would no doubt remember, when a report was read by Mr. E. W. Smith two years ago at the meeting of the Institution of Gas Engineers, there was a gentleman present from America who said they did not think much of gas-fires in his country; and he also stated that they considered hot water was the best thing for the heating of rooms. He said that they had a gas-boiler in America that gave 80 per cent. efficiency; and referred to it as a popular thing with them. Those who had read their technical journals lately would have observed that there had been a great deal of discussion on questions of 90, 95, and 97½ per cent. efficiency gas water-boilers; and there had been no question of getting down as low as 80 per cent. The subject of heating by hot water, as well as that of ventilation, was well worth the attention of gas engineers. He hoped that this system would be very successful.

Mr. John Young (Hull) observed that he was sure they were all indebted to Mr. Brearley for his paper, which would be of more use to them afterwards than in the present for the mere purpose of raising discussion. There was only one point he wished to speak about, and that was in reference to the production of carbonic acid in the atmosphere of a room, factory, workshop, or any other place. The standard set by the Factory Department of the Home Office was simply one as to the presence of so much carbonic acid to 10,000 parts of air. Nothing could be more crude than this. He thought they all knew that the presence of carbonic acid gas did not necessarily mean an impure atmosphere. It was not really a poison; it is only a diluent. A human being might breathe quite a large proportion of it without any harm whatever. The source of the carbonic acid gas was what they ought to look at, and that ought to be specially considered in connection with the question of ventilation. The carbonic acid produced by human exhalations was most poisonous and dangerous, on account of the organic matter and bacteria that accompanied it. It was quite possible that a room heated by an internal stove might be more healthy than without the stove, in view of the destructive effect upon the organic matter and the bacteria. The air of such a room might be better for human beings to breathe, although the gas-stove produced a small percentage of carbonic acid, than the air of a room contaminated by the carbonic acid produced by human respiration.

Mr. Thomas Glover (Norwich) joined with previous speakers in thanking the writer of the paper for the data he had given the members, which would be something to go upon in many cases when they had to consider the question of the heating of rooms by gas-heated radiators either directly or indirectly. The paper was of great value in that way. In Norwich, they had had to consider this matter very carefully; and they had been successful in one or two instances in heating factory buildings with circulators attached to so-called radiators. The word "radiators" one had to use not because it was correct, but because it was now so well associated with the loop type of heating appliance, which were really convectors and not radiators. In the first place, it was rather a daring experiment they made in Norwich to try to heat up a factory with the gas not burning in the actual rooms where the heat was required, inasmuch as they had to fix up at least two radiators in series to get the temperature needed—that was to say, one radiator worked through the second one; and ultimately, as they extended the system, they had to do it through a third. The effect had been so good that the installation had been retained and extended. It had satisfied the factory owner, and it had satisfied the factory inspector; and it had satisfied the Gas Company, because they got an excellent gas consumption. And there was this interesting fact about it (which was mentioned by Mr. Brearley in connection with coke-heated boilers), the gas was lighted under the boilers in winter in the evening when the employees left the premises, and it was kept going all night without any trouble—the factory being quite warm at six or seven o'clock in the morning; and so when the employees assembled, they suffered no inconvenience from frozen fingers. The gas was actually turned off pretty early in the morning; and the factory kept warm right through the day. This was rather an interesting fact; and it took him by surprise when he found that was the practice that had been adopted after a considerable trial. It emphasized the important fact that the walls and furniture of a building stored up a great quantity of heat, and gave it off to the air as it was required—giving a comfortable feeling to the room. Often a mistake was made about this question of radiated and convected heat. They heard a great deal about the virtues of radiated heat. It was nice; but ultimately a great deal of the heat was converted into convected heat. When the rays of heat from a glowing surface were projected through space, they got practically nothing whatever for it; but if the rays of heat were allowed to come into contact with the furniture and walls of a room, they became heated to a certain extent, and yielded their heat in turn to the surrounding air; and so the room became comfortable. He believed that was actually what went on, and said that the heating of large rooms might be carried out with proper consideration for hygiene and comfort. If they were heated by convection, if the heating surfaces were not too hot to start with, and if there was sufficient heating area, he believed that there they had the conditions that were really at the bottom of the heating of large rooms comfortably. He was rather surprised to find that the system of enclosing radiators in a casing, and delivering warm air into a room, was recommended in the latter part of the paper. He was also surprised to find it necessary to employ an induction fan. One would have thought that the rising column of warm air over these enclosed radiators would have been sufficient to give rise to natural induction, without having to resort to artificial induction by a fan. Perhaps the author would take up this point. They did not like to think it would be necessary, in every case, to resort to the "enemy" to bring about the necessary flow of warm air. One would think it could be done naturally—that was, if sufficient outlets were provided in the right place, with the inflow of air sufficient in volume to pass over the radiators or the heating surfaces. The author had confined himself to only one phase of the question. He had rather, in an oblique way, seemed to condemn the use of flueless heaters. But he (Mr. Glover) did not think it wise that wholesale condemnation of these things should come from a writer of a paper before a Gas Managers' Association. In his (Mr. Glover's) opinion, they would have to employ these very useful forms of apparatus in certain situations. Take the condensing-stoves, he looked upon the enclosed argand, with its condensing tubes, as a most useful transportable form of heater. It was cheerful; it was easily fixed; it was healthy, because they got practically nothing but pure carbonic acid from it. The water vapour was condensed out; and any minute quantities of sulphur which might be in the gas were also condensed out with the water. Therefore they had no discoloration of brass fittings, &c., from the minute quantities of sulphur that were in the liquid. They came

back to the point Mr. Young had raised. It was one he himself had also previously raised. The source of carbonic acid was the question. The authorities needed to provide for a clean atmosphere —clean from the point of view of organic poison. If one went into a mineral water manufactory, it was found that quite considerable quantities of pure carbonic acid were allowed in the atmosphere, without any deleterious effects upon the employees. The gas industry claimed the same thing. They claimed if they only produced pure carbonic acid in moderate quantities in heating a factory or other building that they ought to be allowed to continue the system. This was the point they ought to keep insisting upon in discussing the matter with the factory inspectors; and he thought that, with a little persuasion, the inspectors would come round to their point of view.

Mr. A. E. Broadberry (Tottenham) also thanked Mr. Brearley for the useful paper he had put before the members. The subject dealt with was one of which the industry had only merely touched the edge. They had a great deal of work before them in connection with this matter of the scientific ventilation of rooms by warm air; and the apparatus manufacturers of the industry and the engineers in charge of gas-works who were producing and selling gas must necessarily work together in solving the difficulty. He was quite sure Mr. Wilson would not take any serious notice of any good-natured chaff that any of them might put into their writings on this subject concerning the various claims that the manufacturers placed before them from time to time as to who was responsible for this and that. They had to work together in the industry, and had to work out these problems; and he had no doubt they would do so successfully. They had made great strides recently in both branches of the industry—both in the apparatus manufacturing part and in the gas-works. They had all been doing their work in a more scientific way lately than was formerly the case; and the more they brought science to bear on their work, the better surely must be the results. With regard to what Mr. Glover said about taking advantage of the upward tendency of heated air in ventilation, he thought that possibly there was a great deal to be done. He quite agreed with Mr. Glover that it was a pity for them to play into the hands of electricity when there was no need to do so; and if they would take advantage of the ordinary principles of Nature, without calling in the artificial assistance of electricity, it was far better for them to do so. Regarding the argument that Mr. Young produced with reference to the vitiation of the atmosphere by human exhalations, although the factory inspectors had set up a certain carbonic acid standard, he thought they were realizing the difference between the pure and impure carbonic acid, because they attempted to restrict the number of people who were allowed to work in a given covered space. The more they rubbed this subject into the inspectors, the better for people generally. There was much more vitiation of rooms by the occupants than by the burning of gas in them. At the same time, if they could keep the products of the combustion of gas for heating out of a room, and still get a high heating efficiency, it was a very proper object for them to aim at. He hoped they would all work together to this end.

Mr. Brearley, in reply, said he was extremely obliged to the gentlemen who had taken part in the discussion; and he was only sorry that more had not found an opportunity of criticizing the various points that were raised in the paper. Of course, the object of reading the paper had been chiefly to cast in as concise a manner as possible the data referring to the heating of large rooms; and he hoped the tables would be of some use to anybody brought into contact with a project for heating such rooms. He hoped Mr. Wilson would not worry very much as to what he had said in the introduction to the paper. He was sorry Mr. Wilson mentioned that he was one of two makers who did not manufacture flueless radiators; but in another sense he was glad, because it gave him (Mr. Brearley) an opportunity of refuting any idea of condemnation from him of flueless radiators fixed in certain situations. There were many places in which flueless radiators were a great advantage; and he did not condemn them as such. He thought Mr. Glover had rather "missed fire" in saying that, in an oblique way, he (Mr. Brearley) had condemned flueless radiators. He was not condemning them. He merely asked those present to consider whether either flueless radiators or gas-heated water-circulators were permissible—which of the two was preferable; and personally he certainly leaned towards the circulating system. But he did not condemn flueless radiators if gas-heated water-circulators were not permissible. Then, again, as to the question of carbonic acid. He did not take second place to any gentleman in the gas industry for having strenuously fought this question of the percentage of carbonic acid in the atmosphere as a criterion of its purity. But they had to face the fact that it was unfortunately the existing standard at present; and until it was altered, they would have to pay some regard to it. The difficulty of altering it was that no satisfactory means of testing for organic compounds had yet been evolved; and carbonic acid, being a good index, was taken as a fairly easy test. But it was altogether unfair to gas. In his lecture at Manchester, he pointed out that two or three experiments had been made—one at a university in America, in which a man had existed several days in an atmosphere containing 225 parts of pure carbonic acid per 10,000 parts of air; and he suffered no ill-effects at all. On the other hand, he (Mr. Brearley) quoted experiments that had been made of placing animals in an atmosphere of human exhalations; and they actually died. This proved conclusively which did the mischief in the atmosphere of public rooms and workshops. He was glad Mr. Glover had raised the question of the use of fans in these installations. He (Mr. Brearley) also thought they should make themselves entirely independent of any competing agent in these heating installations; and he did not see why it should not be perfectly practicable to make use of the current set up by warm air so as to produce the natural ingress and egress of air over the air-warming radiators. He earnestly hoped that makers would in future installations see whether this was not feasible. He did not know of any installation of the kind on a large scale where there had been freedom from fans.

Mr. H. J. Yates (Birmingham), complying with the promise made to the President, writes:

I have considered with much interest Mr. Brearley's paper read before the Eastern Counties Gas Managers' Association, on the heating of flueless rooms. I am in thorough accord with the sanguine view he expresses as to the advantages of gas in a great variety of cases for the heating of large buildings. When one comes from the general conclusions of his paper, however, to its particular recommendations, one is struck by the versatility of the writer. In former papers from the same hand, one admired his scrupulous care never to lay down a proposition without giving definite data—generally the result of his own first-hand investigation—in proof of it; and equally conspicuous was his constant endeavour to maintain an attitude of judicial impartiality. In this present paper, however, everything is changed. Over against the definite tests of former times, we have a hypothetical hall with a hypothetical set of conditions; and instead of the judicial impartiality, the writer is frankly partisan. He lays aside the judge's robe, and becomes the avowed advocate of one type of apparatus as against all others; and not merely of one type, but of one make, for he does not hesitate to name the particular make of apparatus whose champion he has become. But whether as the impartial investigator of former times, or the confessedly partisan advocate of to-day, Mr. Brearley is always interesting; and I have pleasure in offering a few remarks with reference to his plea for the type of apparatus he champions. Let me say, however, that I shall not follow him in advocating any particular make. When I speak of gas circulators or boilers, I am not singling out any particular make of that type; when I refer to gas-steam radiators, I leave it to your readers to each think of the particular make he may prefer.

Mr. Brearley sets forth the advantages of the use of an outside boiler, and with much of his argument on this head—which by the way is already old enough to be trite—I am in perfect agreement. Indeed, I am able to speak on this question with perhaps more impartiality than Mr. Brearley has been able to attain, because of the fact that my own firm are very large makers of independent boilers for this particular purpose. Where Mr. Brearley has failed is in not being able to take a sufficiently broad view to realize that each method has its own advantages, and that there are numerous sets of circumstances in which either the one system or the other, as the case may be, is preferable to its rival. There is possibly some advantage in the matter of ventilation where the combustion takes place outside the room; but Mr. Brearley has been so impressed with this advantage as to overlook other modifying conditions. Other things being equal, it stands to reason that an apparatus which is situated in the room, and delivers all its heat into it, is more economical than one which has to transmit the heat from the outside, to say nothing of the extra cost of the piping, and, that most essential feature, the lining of such piping. In apartments where there are little or no means of ventilation, then obviously the heating method should not involve combustion in the apartment; and in such cases I have always strenuously advocated the use of an outside boiler. On the other hand, as regards the effect on ventilation of the use of gas-steam radiators, it will be interesting to place alongside Mr. Brearley's hypothetical arguments the fact that, in our experience, test has shown that, in a great many cases, the use of the gas-steam radiator inside the room has actually resulted in a substantial reduction of the proportion of carbonic acid in its atmosphere. Out of many such cases I may mention a very recent one in which the proportion of carbonic acid in the workshop forming the subject of test, was 19·3 parts per 10,000 without the use of the radiators; while, when the gas-steam radiators were used, it was found at the end of the day that the proportion was actually reduced to 8·7 parts per 10,000, owing, of course, to the way in which the use of the radiators in the room stimulated ventilation. Mr. Brearley disclaims any suggestion that flueless gas-heated radiators are inconsistent with the maintenance of hygienic conditions, and wisely so, because, apart from their frequent beneficial effect on ventilation in the apartment which I have just shown, it is very important to remember that the combustion in the room burns up poisonous organic matter in the air which, as is well known, is immeasurably more harmful than carbonic acid of any kind, and particularly carbonic acid produced, not by respiration, but by the combustion of gas.

In this connection it may perhaps be interesting to contrast the Mr. Brearley of 1907 with the same gentleman in the present year of grace. In a paper read by him at the Manchester Exhibition [" Journal," Vol. C., p. 424] Mr. Brearley says:

No gas engineer would be audacious enough to claim that the sterilization of the air of living rooms is completely effected by gas lighting; but he would be well within the limits of truth if he claimed that large portions of such air is sterilized. . . . When you reflect

upon the amount of air which is set in circulation by burning gas, as will be demonstrated, you must know that large volumes of it are subjected to considerably higher temperatures than those given. As it circulates in and around the gas-flame, the bacilli, and the spores of bacilli, are destroyed. Not only is the foul air of respiration sterilized, but the dangers of dust—that conglomeration of dead flies, street sweepings, and the like—are minimized. In this direction gas . . . performs a great purifying function.

In that paper Mr. Brearley was dealing more particularly with the use of gas for lighting; but he would hardly draw any distinction in this connection between gas used for lighting and that used for heating the same apartment.

Mr. Brearley does me the honour of quoting a sentence from a recent paper of mine with regard to the escape of the products of combustion by diffusion through the walls and ceiling; and he remarks that this is an unfortunate description of what happens. Unfortunate it no doubt is for Mr. Brearley's line of argument; but all the same it is a perfectly correct account of what takes place as far as is at present known. Mr. Brearley himself in the paper I have already quoted from, says: "When the gas is burning, there is a stream of heated products towards the ceiling." This is precisely what I said in my paper. If the heated products escaping by diffusion take their heat with them, there might have been something to say for Mr. Brearley's argument; but he would doubtless be the last person to make such a suggestion. My paper was written before Dr. Toogood's report appeared in the "Medical Magazine" for February. In that report, Dr. Toogood, giving the results of his own independent investigations, absolutely confirms what I said in my paper. He states:

That in large rooms, adequately ventilated, flueless gas-stoves can be used for heating without any hygienic disadvantages; the heated products of combustion (mainly carbonic acid and water vapour) ascending quickly above breathing level. This method of heating—by radiation and convection from flueless gas-stoves—is economical; but proper ventilation of the buildings in which it is adopted is essential, which, of course, is also the case whatever means of heating be adopted. A ward or other public building in which gas-radiators cannot be used with advantage is improperly ventilated.

The one definite proposition to be drawn from Mr. Brearley's paper is that the outside boiler is a more economical means of heating than the gas-radiator inside the apartment. If the outside boiler be used in conjunction with radiators inside the room, I need only once more point out that, obviously, an apparatus giving its entire heat inside the room is more economical than one which has the necessary loss of heat from transmission into the room; and when one comes to the other alternative, which appears to be the one favoured by Mr. Brearley—of heating the air outside the room and sending this into the room—one simply stands aghast at the extravagance of electric motors and fans, &c., which Mr. Brearley so airily recommends, but the cost of which he so judiciously ignores.

MR. EMERSON DOWSON ON GAS-PRODUCERS.

At the Meeting of the Institution of Mechanical Engineers last Friday, Mr. J. Emerson Dowson read a paper on "Gas-Producers." On the same occasion, one on "The Effect of Varying Proportions of Air and Steam on a Gas-Producer" was submitted by Mr. E. A. Allcut, M.Sc., late Bowen Research Scholar in the University of Birmingham. We give to-day some extracts from Mr. Dowson's paper; leaving the other for notice in a subsequent issue.

The author began by explaining that when he undertook to write his paper he realized that he would have to confine himself to the consideration of the construction and working of gas-producers, as it would not be possible to include the application of the gas to the numerous purposes for which it is used. Originally this gas was made exclusively for heating furnaces; but now it is adopted extensively for engines, and for smaller kinds of heating work in industrial processes, as well as for cooking, baking, and other domestic purposes. This has led to the use of suction as well as pressure gas. There are many makers of gas plants, but most of them have merely introduced modifications in detail which do not affect the principles involved; and the author said he proposed to confine himself to certain types of gas-producers, and to discuss their leading features from the theoretical and practical points of view. He advised those of his audience who wished to trace the growth of the subject historically to read the paper by Mr. I. Rowan on "Gas-Producers" to be found in the "Proceedings of the Institution of Civil Engineers" for 1885 (Vol. LXXXIV.), and the useful work of M. Jules Deschamps, on "Les Gazogènes," published in 1902.

Before considering distinctive types of producers, the author reviewed briefly the principles and conditions on which the production of producer gas depends; and he showed that, subject to minor variations, the chemical reactions are, and must be, the same in kind for both pressure and suction gas. He described the various producers, beginning with the first internally-fired one—that of Bischof—invented in 1839. The next stage in the development of the producer was reached in 1861 with the introduction by Siemens of a novel and ingenious arrangement for obtaining the necessary in-draught of air, and for causing the gas produced to flow to the furnace. Following this came the producer designed by M. Tessié du Motay in 1871, the leading feature of which was a solid hearth without a grate of any kind. Five years later, Messrs. Brook and Wilson introduced a producer which also had a solid hearth, and air was injected by a jet of steam under pressure. From time to time various modifications and improvements have been introduced by Siemens, Mond, Duff, the author, and others; but he said the examples he had given were sufficient as types to show the development of the gas-producer used for making semi-water gas or mixed gas. About the year 1874, however, Mr. Lowe made a new departure, and produced water gas alone by means of his now well-known plant. Messrs. Dellwik and Fleischer have devised a modified apparatus for the production of this gas, in which the period of the "blow" is greatly reduced. The Loomis-Pettibone plant is another modification.

The author then proceeded to consider the "suction" type of gas-producing plant. He pointed out that in some of the early gas-producers air was drawn in by suction, instead of being forced in under pressure, as in those of later date. In recent years, the idea of working the producer by suction has been reverted to, chiefly in connection with gas-engines. As early as 1862, Dr. Jacques Arbos, of Barcelona, devised a combination of gas plant and engine in which the latter drew gas direct from the producer. It was not a very practical arrangement, and the charge of gas and air was not compressed before ignition; but Mr. Dowson thought it should be mentioned as one of the early suction plants devised. The first to give effect to this idea in a practical way, with a compression engine, was M. Léon Bénier, of Paris, in 1891, who afterwards introduced some improvements in his plant. The engine had a suction pump by the side of the motor cylinder, and this pump was connected by a pipe with the outlet. As soon as the fire was lighted, it was blown up with a hand-power fan; and when the gas was good enough to work the engine, the latter was started. The pump on the engine then drew gas from the producer and forced it into the motor cylinder. This suction of gas from the producer lowered the pressure in the latter, and consequently air from the outside flowed in through the inlet. The steam or aqueous vapour formed in a revolving grate containing water mixed with the air before the latter entered the fuel column, and both steam and air were drawn together into the fire. The volume of air drawn in varied with the rate at which gas was consumed in the engine—in other words, the rate of producing the gas was governed automatically by the engine itself; and both the gasholder and the independent boiler were dispensed with altogether. The gas produced was poor in quality; and there was the friction of the pump as well as other drawbacks. The fuel consumption with this combination of gas plant and engine was therefore higher than with a pressure plant and its independent boiler.

It was seen, however, that the working of a plant by suction in combination with an engine would have distinct advantages if the practical details could be worked out satisfactorily. Several engineers gave their attention to the subject; and the next step of importance was to do away with the pump on the engine, and to use the suction of the engine itself to draw gas from the plant. This reduced appreciably the loss from friction. Also various improved methods have since been devised for producing the steam required, and for removing the clinker formed in the producer. Apart from producing sufficient steam when the maximum volume of gas is required, there is the further necessity for regulating the quantity drawn into the fire when the load on the engine is variable.

In order to compare the gas made in a suction plant with that made in a steam-jet pressure plant of the same power, the author gave in the following table (compiled from volumes of the "Proceedings of the Institution of Civil Engineers") the results obtained with a 40 B.H.P. plant of each type working with anthracite, and in a separate column the average results of seven different pressure plants of various sizes, ranging from 8 to 300 H.P., all starting hot:—

Composition of Gas. (Per Cent. by Volume.)	Suction Plant.	Pressure Plant.	Average of Seven Pressure Plants of Different Sizes.
Hydrogen	15·64	19·8	17·36
Methane	1·16	1·3	1·20
Carbon monoxide	20·13	23·8	25·55
Carbon dioxide	6·09	6·3	5·77
Oxygen	0 74	..	0·30
Nitrogen	56·24	48·8	49·82
Calorific value (higher scale)—			
B.Th.U. per cubic foot	135·3	164·4	161·0
Calories per cubic metre	1204	1463	1432

From these figures, it appears that the calorific power of the pressure gas is approximately 20 per cent. higher than that of the suction gas. The practical result is that there is a loss of about 5 per cent. in the maximum power of the engine when worked with suction gas. This is not important for small engines; but for those of larger size it must be taken into account. In considering the two types of plant for engine work, the author said the general conclusions might be as follows: A suction plant has certain practical advantages. It costs less, and occupies a smaller ground space. But the gas made in it is not so strong as in the

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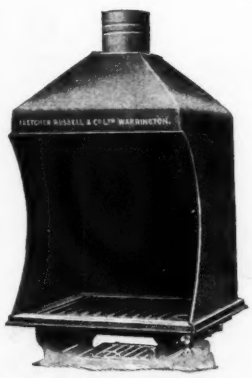

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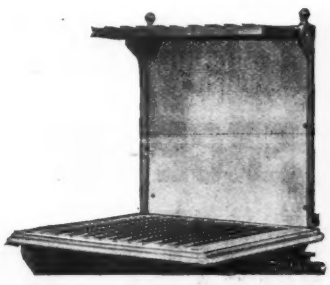

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older form of pressure plant; and in some cases this advantage of the latter is important. The fuel consumption per horse-power-hour and the labour required are about the same in both types of plant, provided the steam required is raised without an independent boiler. The consumption of water is the same in both types. Where there are several engines to serve, the arrangement of the gas-pipes is greatly simplified, and their cost is proportionally reduced; further, the engines can be started more readily when the gas can be taken from a small gasholder instead of from several suction plants.

The author said there were many interesting questions affecting the working of an engine when suction gas is used; but they were beyond the scope of his paper, and he rather reluctantly refrained from discussing them. He thought, however, it was desirable to consider the variations in the quality of suction gas when the engine is working with light and variable loads. On this subject, he made the following remarks: It has been seen that in a suction plant the quantity of gas produced is regulated by the action of the engine, as there is a draught of air and steam through the producer every time gas is admitted to the engine. If the latter is of the Otto type, the gas-valve opens at every fourth stroke when there is a full load; but when the engine is governing, the valve is opened less frequently, and consequently there are longer intervals between the intakes of air which are drawn into the producer. It is therefore important to consider how this varying quantity of air affects the condition of the fire and the composition of the gas. It is safe to say that no producer makes gas of equal calorific power at all rates of production; and, speaking quite generally, it may be assumed that the best gas will be made when the producer is worked uniformly at or nearly at its maximum capacity. At any rate of production considerably less than the maximum, the calorific power of the gas will be lower. To test this practically, the author had some trials made with a 40 B.H.P. engine working with a full load and with no load at all. The gas was made with ordinary gas coke. The full-load test was made when the fire was in good working order; and the no-load test was begun by throwing off the load and the belt, while the engine continued to run at the same speed. The no-load test lasted three-quarters of an hour. The following analyses represent the average composition of the gas (per cent. by volume) in each test:

	Full Load.		No Load.
Carbon monoxide	27·65	..	22·4
Hydrogen	9·85	..	7·0
Carbon dioxide	3·80	..	4·9
Oxygen	0·30	..	0·5
Nitrogen, &c.	58·40	..	65·2
Calorific power—			
B.Th.U. per cubic foot	128·9	..	101·0
Calories per cubic metre	1147	..	899

The author had this further tested at Derby in 1906, during the trials of suction plants made on behalf of the Royal Agricultural Society.* To test their working with widely different loads, the Judges ordered the plants to be run for two hours with no load immediately after starting-up in cold producers, then for one hour at full load, then for another hour with no load, and afterwards for successive periods of one hour each with one-quarter, one-half, and full loads. The author took this opportunity to have numerous samples of the gas taken in one of his own 20 H.P. plants working with small anthracite under these varying conditions, and the following are the results:—

Conditions of Working.	CO.	H_2.	CH_4.	CO_2.	O_2	N_2.	Calorific Power.	
							B.Th.U. per Cubic Foot.	Calories per Cubic Metre.
No load	10·20	11·05	2·15	11·2	0·1	64·70	102·7	913·9
,, ,,	12·45	12·15	2·00	10·1	..	63·30	105·8	941·5
Full load	22·25	15·90	1 95	5·25	0·1	54·65	152·3	1355·3
No load	18·30	13·60	1·20	9 05	0·3	58·55	122·8	1092·7
Quarter load	20·00	11·80	0·75	8·35	0·1	59 05	117·5	1045·6
Half load	20·90	14·00	0·70	7·7	..	56·70	127·7	1136·4
Full load	21·50	14·50	1·20	7·6	..	55·20	136·8	1217·3

As was to be expected, the gas contained smaller percentages of carbon monoxide and hydrogen, and larger percentages of carbon dioxide and nitrogen, during the no-load periods. It will also be noticed that while the gas made with no load on the engine, immediately after starting in a cold producer, had a low calorific power, and did not materially improve while the producer continued to work without load, yet after the producer had worked for a time at full load, and had become thoroughly heated up, with a good depth of bright fire, it gave gas of considerably higher calorific power than before when the load was again removed. The explanation of this is mainly a question of temperature. At full load, the intermittent draughts of air through the fire follow one another in quick succession, and the fuel is maintained at a high temperature. When there is no load, there are comparatively long intervals between the intakes of gas; so that in the producer there are short, sharp suctions of air with intervals between them during which the temperature of the hot fuel falls. After the producer has been working for a little time at full load, the depth of bright fire is sufficient to make good gas during each of these periods of suction, and the temperature does not at once fall; so that the producer continues to make fairly good gas for a considerable time after the load has been removed.

If the producer were worked by the continuous suction of a fan, instead of by the frequent intermittent suctions of an engine, the quality of the gas would be practically the same under full load; the volume of air drawn in per minute being the same for a given power. During the no-load period, the effect would not be quite the same. With a fan there would be a steady draught of the volume of air required, and there would be a shalllow zone of fire near the grate, which would be maintained at a sufficiently high temperature to make good gas; and gas of good quality would be produced as long as this hot zone was sufficiently deep in relation to the size of the fuel. If the air for the producer were drawn in by an engine without load, a greater depth of fuel would be heated by reason of the more rapid draught of air through the fire; but a good deal of heat would be dissipated before the next suction. This points to the importance of maintaining the temperature of the fire as high as possible when the producer is worked at a reduced load by the suction of an engine; and a step in this direction is to reduce the quantity of steam proportionally to the volume of air drawn in. If the production of steam is continuous while the in-draught of air is intermittent, it follows that after each interval there must be an excess of steam mixed with the air, unless some way of regulating the production or admission of the steam is adopted. If there is too much steam during the light loads, this of itself lowers the temperature of the fire and adds to the trouble caused by the small amount of air drawn in. If the air is heated before it reaches the fire, this also will assist to maintain the temperature required. It is not easy to fulfil all these conditions without complicating the apparatus; but it is well to consider what will give the best results, so that a near approximation may be obtained.

It is well known that after an engine has been working under a light load for some time with a suction plant there is risk of stoppage if the full load is put on suddenly. Moreover, when this occurs, it is often attributed to an insufficient supply of gas. This is a mistake, as the volume of gas necessarily varies directly in proportion to the load on the engine. It is the quality of the gas which is at fault; and the explanation of this fact is not far to seek. It has been seen that during the light-load period the temperature of the fire falls, and that for a few moments after the full load has been put on there is too little hot fire; so that what there is is not hot enough to effect the necessary chemical reactions. There is too little hydrogen, and not enough of the carbon dioxide is reduced to carbon monoxide. The remedy is to put on the full load more gradually (so that the engine may be kept running at full speed in spite of the weakness of the gas), and to check the admission of air to the cylinder; the fire in the producer will recover rapidly, and there will soon be a full supply of gas of good quality.

During the Derby trials with anthracite, the author had numerous samples taken of the gas made in a 20 B.H.P. Dowson plant; and the following figures represent the average analyses (per cent. by volume) for full and half loads:—

	Full Load.		Half Load.
Carbon monoxide	21·95	..	18·90
Hydrogen	13·85	..	14·05
Methane	1·55	..	1·60
Carbon dioxide	7·20	..	8·05
Oxygen	0·10	..	0·05
Nitrogen, &c.	55·35	..	57·35
	100·0	..	100·0
Calorific power—			
B.Th.U. per cubic foot	139·7	..	130·5
Calories per cubic metre	1243·5	..	1161·5

It will be seen that at half load there is less carbon monoxide and more carbon dioxide and nitrogen, owing to the lower temperature of the fire in the producer. Consequently, the gas is weaker; but it is satisfactory to note that the difference is not great between full load and half load. It should also be understood that there is no difficulty in working a suction plant with a steady load which is only a small fraction of its maximum; the difficulty arises when a considerable increase in the load is put on suddenly, after working with a low load.

Producer gas can be obtained with almost any kind of carbonaceous fuel, and when tarry vapours are mixed with the gas they can with advantage be burnt with it in furnaces; but for engines and small heating work all such vapours must be eliminated before the gas reaches the valves, cocks, &c. Hitherto this has been done by centrifugal tar-extractors, washers, and other apparatus which add to the complication and cost of the plant. Some attempts have been made to draw off the vapours from the upper part of the producer and return them to the lower part of the fire where combustion takes place; but, so far as the author is aware, none of these plants have been altogether successful. Another method of fixing the vapours is to work the producer with a down-draught instead of an up-draught. In this way, the tarry vapours from the raw fuel (put in at the top) are compelled to pass through the whole depth of the fire, so that they may be converted into fixed gases. It is almost impossible to do this effectually in continuous work, owing to the difficulty of maintaining a suitable temperature. It is also difficult to burn the fuel completely, and usually there is an accumulation of small

* The trials referred to were noticed in the "JOURNAL" for Dec. 25, 1906 (p. 891).

carbon or coke, mixed with clinker and ash, in the lower part of the producer.

The author has always held the opinion that the tarry vapours should be got rid of in the producer itself, and that it cannot be right to let tarry gas leave it and then have to remove the tar by extractors, &c. Accordingly, he designed, in 1903, a double-acting producer—*i.e.*, one in which air is drawn in through both the top and the bottom of the fuel column. The coal is put in at the top, and the upper part of the fire burns downwards. The hydrocarbons are distilled off, and various useful reactions occur; the coke which remains sinking gradually into the lower part of the producer, where it is converted into ordinary producer gas by the upward current of air (accompanied by steam) which is drawn in at the bottom. The mixture of gases leaves the producer through an outlet about half-way between the top and bottom. When working with ordinary bituminous coal, or with lignite and several other varieties of fuel, there is no tar. It is disposed of altogether in the producer, and no mechanical or other tar-extractor is required. After leaving the producer, the hot gas passes through an external vaporizer to cool it and so raises the steam required for making the gas. It then passes through suitable scrubbers, and is ready for use in the engine to be worked with it. This bituminous plant can be worked by the suction of an engine; or when the gas is to be passed into a gasholder for distribution to several engines, or to heating apparatus, there is an exhauster to draw it from the plant and deliver it into a holder.

The author stated that it took a long time to perfect the details of this plant; but one for 500 H.P. was started in October, 1908, at West Bromwich, and has been working regularly ever since. The results were so satisfactory that in the following October a second plant of this type for 700 H.P. was started; and both plants are now serving 13 gas-engines which were previously worked with anthracite pressure gas. The calorific power of the gas is nearly as high as that of gas made with anthracite in an ordinary suction plant. The coal cost 8s. a ton delivered, against 23s. for anthracite. On an average of several months, the consumption of bituminous coal was about the same as with anthracite—viz., about 1 lb. per I.H.P.-hour, including all stand-by, cleaning, and starting losses. The gas has no tar on leaving the producer, and none is found in the scrubbers or overflow water; and the firm for whom the plant was erected state that the gas from the bituminous coal is as clean as the anthracite gas previously used. They clean the engine valves only once in about three months. Among other plants of this type in operation, a Leicester firm are working one for 400 B.H.P.; and they find their engines run as well with it as with the anthracite plant they previously used. At first the author thought these plants would not be suitable for small powers; but more recently he has had a 30 H.P. suction plant of this type working regularly about eight months, and it has given no more trouble than an ordinary suction plant working with anthracite or coke. The engine valves were not cleaned for five months.

MM. Boutillier et Cie. have a producer in which bituminous coal is forced into the bottom of the fire by means of a screw-feed; and as the producer is worked with an up-draught from a blower, the tarry vapours distilled off at the bottom pass through the incandescent fuel above. Power is, of course, required to send in the coal; and the rate of feed must be regulated to suit the rate of consumption. The author has seen a plant of this type working well with semi-bituminous Belgian coal, containing 12 to 13 per cent. of volatile matter. He does not know what the result would be with English coal, which usually contains not less than 30 to 35 per cent. of volatile constituents.

In conclusion, the author pointed out that for engine work the stand-by loss of a steam-boiler is much greater than that of a gas-producer; and he said the explanation was not far to seek. For a given horse power, the producer is much smaller, and has far less radiating surface, than a boiler; it has no water in it to be heated; and in a few minutes it can be worked up to its maximum production after standing almost any length of time. With a boiler, except in the vertical or portable type, there is a large amount of external brickwork to be heated, and there is a considerable quantity of water, even in the tubular type. When the boiler is standing, the water and the brickwork lose heat; and not only more time but more fuel is required to make up this loss than in the case of a gas-producer. The results are:—

Steam Power.			Gas Power.	
Type of Boiler.	Maximum Horse Power of Boiler.	Coal Consumed per Standing Hour.	Maximum Horse Power of Producer.	Coal Consumed per Standing Hour.
		Pounds.		Pounds.
Various	100	14·0	250	5·1
Lancashire	450	37·5*	250	3·9
Babcock and Wilcox	210	67·0	100	2·1
,, ,,	210	67·0	250	4·5
,, ,,	500	180·0	225	3·8
,, ,,	500	112·0	375	1·8
Niclaussé	400	50·0	..	..
Lancashire	400	44·7	..	..
Average	..	71·5	..	3·5

* Exclusive of raising the steam pressure from 90 lbs. to 120 lbs.

On this basis, if a 200 B.H.P. steam-boiler works for 8 hours and is standing 16 hours, and if it consumes 2·5 lbs. per B.H.P.-hour, the stand-by loss will be upwards of 20 per cent. of the total fuel consumed in 24 hours. Under like conditions, if a gas-producer of the same power consumes 1 lb. per B.H.P.-hour, the stand-by loss will be less than 4 per cent. of the total fuel consumed. With a 500 B.H.P. boiler, the stand-by loss will be about 15 per cent., and with a gas-producer less than 2 per cent. If the percentage of the stand-by loss on the fuel consumed during the working hours is taken, the following results are obtained: 200 B.H.P.—Steam power, 26·8 per cent.; gas power, 3·8 per cent. 500 B.H.P.—Steam power, 17·9 per cent.; gas power, 2 per cent.

OXIDE PURIFICATION.

By Ernest Scears, of the Hampton Court Gas Company.

[A Paper read before the London and Southern District Junior Gas Association. April 28.]

The subject of the purification of gas from sulphuretted hydrogen by means of oxide of iron is one which is so old that it may at first seem almost hopeless to find anything sufficiently novel or interesting concerning it to which an evening can be profitably devoted; but I have been induced to put these few notes and thoughts before you with a hope that they may in some small measure increase the knowledge of the members of the Association in this particular branch of gas manufacture, and also encourage some to inquire into it still further, and so find means of improving upon present practice.

The capital cost of the purifying plant and the ground area usually covered by it seems quite out of proportion to the amount of sulphur impurity in the crude gas. It is an item, therefore, where economy seems needed, not only in working, but in construction, and this even more now than formerly, since, with the prevalent and increasingly high temperature of carbonization, the percentage of sulphur compounds is also found to increase. Because the labour cost of oxide purification has been in the past only a fraction of a penny per 1000 cubic feet, yet it does not logically follow that it should be neglected on this account; and economy, or rather more efficient utilization, is undoubtedly still possible on a large number of works.

There is, however, one aspect of the question which is an important one. The condensing and scrubbing plant can do much to prolong the working life of the purifiers proper. It is not always sufficiently recognized that crude gas contains enough alkaline matter to neutralize a large amount of its acid impurities, and the great difference in the cost of purification at various works may perhaps be accounted for not so much by the kind of boxes in use and the methods of working same, as by the full benefit not being derived in the earlier stages of manufacture.

Oxide purification has been carried out for a very great number of years in almost precisely the same manner at practically all gas-works; and during the time there have been scarcely any improvements, either in construction or methods of working, calling for special attention. The admission of air into the manufacturing plant, for the purpose of revivification, is nearly as old as oxide of iron purification itself. About 1853, the South Metropolitan Gas Company published statistics showing that 2 per cent. had no effect on the illuminating power. At the same period, I believe, purifiers were constructed by that Company admitting gas to the top instead of the bottom of the boxes.

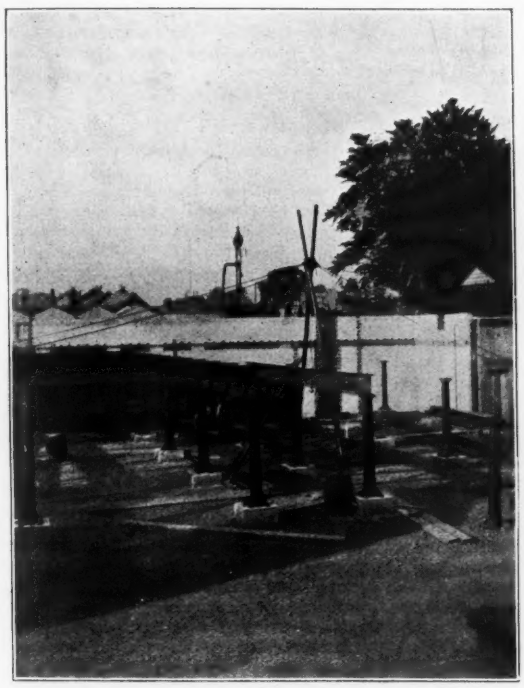
Attention is occasionally directed to new and promising processes; but it is only within the last two or three years that, by a slightly different method of working the apparatus such as is found at nearly all gas-works, it has been proved possible to completely revivify the sulphided material while in the boxes, and while still doing useful work in purifying the foul gas from sulphuretted hydrogen. The method of working I refer to is that known as the "reverse action system," and when the matter was aired in the Technical Press and at Association meetings, a number of engineers up and down the country commenced experimenting with the new method, and some results obtained have already been published.

At the works where I have the privilege to serve, the Engineer has been experimenting with this system for some years past; and since December, 1908, we have been working by it continuously with surprisingly successful results—proving the possibility, with boxes of sufficient area, of complete revivification without removing the oxide from the boxes, thus effecting considerable economy. I have been intimately associated with the experiments referred to, also with the erection of a new purifying plant at Hampton Wick.

Purifiers at Hampton Wick.

The purifying plant at Hampton Wick consists of four luteless boxes, 30 feet square and 5 ft. 6 in. deep, inside measurements. These were erected in 1908, by Messrs. Robert Dempster and Sons, of Elland. They are arranged in two pairs, separated by a central 6-foot gangway, in which are 24-inch diameter inlet and outlet mains supported on sling joists, and eight single Weck type valves bolted outside the boxes. There are separate inlet and outlet valves to each box, so arranged that the purifiers may be worked in any consecutive order, either forward or backward rotation, or any three or two in consecutive order, or any one

alone. The system of three on and one off compels 25 per cent. of the plant to lie idle and stagnant, instead of giving the purifying material contained therein a chance of revivifying by the oxygen carried forward from the other boxes. Moreover, there is a certain amount of danger with the "off" box if the centre-valve passes a little gas, which is not an impossibility.



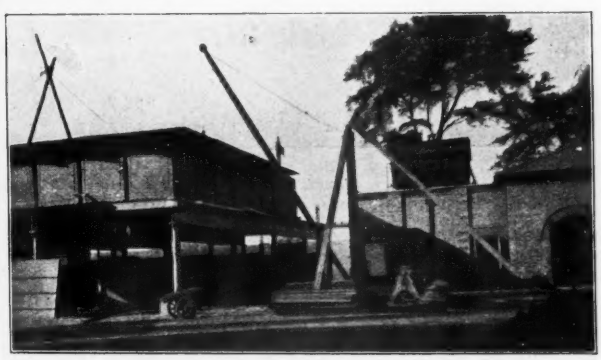
Foundations, Supporting Columns, and Girders.

The purifiers are supported upon 30 cast-iron columns of 1-inch metal, 7 feet long, tapering from 10 inches diameter at the base to 8 inches at the cap. Each column is bolted down to the foundations by four $1\frac{1}{8}$-inch bolts 18 inches long, connected at their lower ends by 3 in. by $\frac{1}{2}$ in. flats. The necessity for good foundations is evident from the fact that the total approximate weight of the purifiers, including all ironwork and oxide, was calculated at 576 tons, which is equal to a load of about 36 tons on the centre columns. It may be interesting to relate that, when the purifiers were constructed, some difficulty was experienced in getting good foundations, because six of the columns came within the area of an old gasholder tank which had many years before been filled in with clinkers and rubbish. In those cases, the bases of the columns rest on concrete piers about 21 feet deep.

Erection of Purifiers.

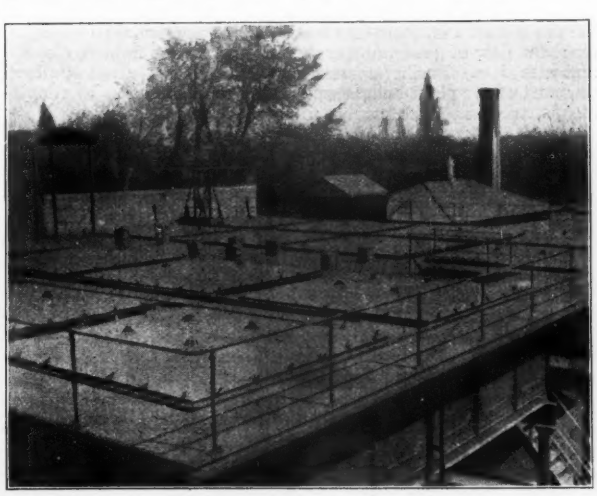
Bolted to the caps of the columns are six lines of 18 in. by 7 in. rolled steel joists, and bolted to these thirteen lines of 10 in. by 5 in. transverse joists. The transverse joists are separate for each pair of boxes, and not continuous. The bottom plates are 5 feet square, and the side and end and division ones of such a depth as to make the boxes 5 ft. 6 in. deep inside—all being of $\frac{3}{4}$-inch metal. The flanges, which are web strengthened, are $3\frac{1}{2}$ inches wide by $\frac{7}{16}$ inch thick, and are external, with the exception of those at the top, which are internal. There are four openings, 12 feet square, on the top of each box; and around these openings the plates are cast with a channel curb about 4 inches high and a top flange 4 inches wide, with slots for the swing bolts which secure the covers.

The covers are built of 6 in. by 3 in. by $\frac{7}{16}$ in. angle steel curb, and a framing of $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. by $\frac{5}{16}$ in. steel angles in one direction and 2 in. by 2 in. by $\frac{1}{4}$ in. in the other; the whole being covered with $\frac{1}{8}$-inch curved sheets. Each cover is fitted with Clapham's patent "Eclipse" rubber joint; and it is worthy of remark that four covers, which were screwed down gas-tight for 24 months without being raised, came up at the end of that time easily and without sticking.



Derrick Used During Erection.

Two cranes are provided for lifting two covers at the same time, and they run on 4 in. by 2 in. channel steel rails of 32-inch gauge between the two sets of covers—being so arranged as to travel to a sufficient distance to carry the covers lifted clear of the purifier which is being emptied. There are three tiers of ordinary flat deal grids with oak sides, and a space of 16 inches between each tier, allowing room for about 12 inches depth of oxide. Each purifier has attached to the bottom plates four 16-inch diameter discharging shoots 21 inches long, provided with a faced lid and tightening lever with handwheel for securing same. Inside, and over these shoots, are steel hoods long enough to project above the top layer of oxide, and provided with a lifting eye to enable them to be withdrawn by the cover-lifting cranes.



Top of Boxes, showing Covers and Cranes.

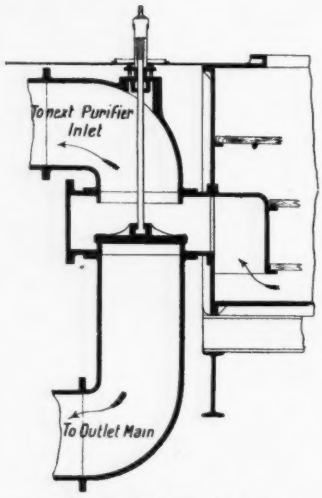
An important, and yet rather unusual, feature is that the inlet gas is led to the top of each box, and the outlet taken from the bottom, or the reverse of the usual practice. It was considered advantageous to admit gas to the top of the boxes first for several reasons. Pressure will first form there, when the oxide in the top tray can be changed or loosened without disturbing the remainder in the box; and if the hoods over the discharging shoots are made in three short lengths, it greatly facilitates the removal of each successive layer of material. Moreover, gas entering the top of a purifier comes into immediate contact with a surface of purifying material over the whole area of the purifier, instead of half the area being wooden grids such as the gas would encounter if admitted at the bottom. When gas is admitted at the bottom,

Four Purifiers, 30 Feet Square, on Superstructure at Hampton Wick Gas-Works.

any moisture or tarry matter would more readily be filtered out and absorbed by the small area of oxide between the bottom layers of grids; thus giving rise to back-pressure.

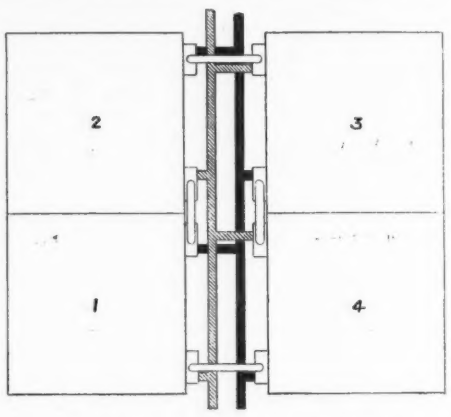
At the front end of the central gangway is a 3-feet staircase, giving access to the top from the ground; and at the other end of the gangway a hydraulic telescopic lift with automatic stop and relief valves capable of lifting two 7-cwt. bogies of oxide. This lift is provided with an expanded metal fencing around three sides, and lifting-gates for the open side. The side-tipping bogies used for transferring the oxide from the revivifying floor to the platforms around and between the 12-feet openings in the top of the boxes are provided with two wheels in the centre of the carriage, and one wheel at each end; the latter wheels being somewhat smaller than the centre ones. This allows the bogies to be pushed easily around the rather sharp corners and narrow gangways between the openings. The space underneath the boxes has proved to be a useful revivifying floor, and was covered for this purpose with 2 inches of granolithic concrete—a composition of equal proportions of granite chips and Portland cement.

In many works, the purifier connections seem to be put down somewhat like a Chinese puzzle; and the confusion is worse where no plan of them is kept. Some of us, no doubt, in our visits to various works—especially small ones—have experienced difficulty in understanding the numerous valves and connections. On the other hand, there are works where the practical eye can trace the flow of gas from the retort-house to the holders clearly and with ease. Purifier connections which do not admit of all or any part of the plant being turned into or out of action by simple means, are not complete or up to date.



Section of Single Weck's Valve.

The Weck type of valve is extremely simple in construction, as a glance at the accompanying illustration will show; and it permits of the connections between the boxes and the mains being so arranged that they can be easily understood. The lower part of each valve-box connects by a bend to either the inlet or outlet main, and the upper part to the valve of the adjoining purifier. Between these two openings a disc is provided with a screwed spindle, which passes through a stuffing-box and gland. By the action of this spindle, the disc is raised or lowered to close either the upper or lower opening as desired; and it is obvious at a glance which valves are open and which are shut by the height of the spindles—thus minimizing any chance of wrong valves being turned. It is very important, however, that the screwed spindles be kept well oiled and protected from the weather and dirt or oxide; also that they are not left too long without being worked, otherwise they are liable to stick and cause trouble. Those valves which may be safely moved should be worked regularly every week, not only to keep them in regular working order, but also to allow any condensation which has collected on them to run away through the main inlet and outlet pipes to the nearest syphon



Inlet mains . . . . . shaded
Outlet mains . . . . . black
From one purifier to the next . white

Diagrammatic Sketch of Purifier Connections at Hampton Wick.

Pipes for testing either pressures or impurities should be brought from between each tray, and from the main inlet and outlet pipes, to one convenient spot, and either a permanent gauge fixed up, or a hook provided on which the works gauge may be hung and connected to each pressure pipe in turn. Trouble from back-pressure can thus be easily located.

Rubber-jointed covers are now universally recognized as a great advantage over the old water-seals which were in vogue for so long; and they are practically the only improvements in purifier construction for many years calling for special attention. One of their many advantages is the absence of trouble and risk in winter from frozen lutes. Then, again, heavy overhead girders and lifting apparatus are unnecessary; and there are no expensive lute plates to cast—the saving in capital outlay compared with water lutes being about 18 per cent. The jointing should, for preference, be attached to the cover; and the surface with which it comes in contact when in use, as well as the rubber itself, should be well cleaned and covered with a mixture of black lead and soft soap. The amount of gas lost by water-seals blowing is considerable; but it must be remembered that it is advisable to have some relief in case of excessive pressure. When rubber joints are adopted, this should be arranged for. The strains on the side plates are much less where multiple covers are adopted, and substantial cross ties are formed by the gangways for resisting the outward

pressure of the gas and oxide. On the other hand, multiple covers with rubber joints have not such a great advantage when the boxes are on the ground level, as the gangways form an obstruction to throwing out the spent material over the sides.

The Chemistry of Purification.

Before describing our method of working, it would perhaps not be out of place to consider for a moment the chemistry of the use of hydrated peroxide of iron for the absorption of sulphuretted hydrogen; and without entering into any elaborate explanation of the changes that take place, I will summarize those equations which are most important, and which should be clearly understood if we are to work scientifically and get the greatest efficiency from the plant at our disposal.

The formula expressing the net result is:

$$(a)\ 2H_2S + O_2 = 2H_2O + S_2.$$

But the action is an indirect one, and is produced as follows:

$$(b)\ Fe_2(OH)_6 + 3H_2S = Fe_2S_3 + 6H_2O$$

which expresses the chemical reaction actually taking place in the purifiers, and

$$(c)\ Fe_2S_3 + O_3 + 3H_2O = Fe_2(OH)_6 + 3S$$

the action of revivification upon exposure of the sulphide to oxygen.

Reverse Action System of Working Purifiers.

The essential feature of this system consists in admitting a small percentage of air with the gas to be purified, and arranging for the air to come into contact with fouled oxide when the latter is in a suitable condition to absorb oxygen. It has been found by chemical experiment that when the purifying material is absorbing sulphuretted hydrogen from the gas, and hence being converted from oxide into sulphide, it cannot at the same time and in the same box absorb oxygen, and so be revivified *in situ* as completely as theory seems to show it should be according to the formulæ previously quoted, although regeneration no doubt does go on partly in the active boxes of the series. But, on the other hand, if the oxygen is allowed to come into contact with the sulphided material in a box which is for the time not being used for the absorption of sulphuretted hydrogen, then its action is much more certain and complete. This can be arranged in practice, provided the valves and connections are designed so that the purifiers may be worked in any number and any sequence.

The gas is admitted into the first box, and then into the second, third, and fourth, which for clearness I will designate Nos. 1, 2, 3, and 4. No. 1 will first show foul; then No. 2. As soon as a slight trace of sulphuretted hydrogen is shown to be passing No. 2, No. 4 is made first, and the other boxes following—thus, Nos. 4, 1, 2, 3, having a clean box on first and last. No. 4 then effectually purifies the foul gas from all sulphuretted hydrogen, and clean gas containing oxygen passes forward into the sulphided boxes Nos. 1 and 2, revivifying the material in them. When Nos. 4 and 1 show foul, then No. 3 is made first, and No. 2 last—thus Nos. 3, 4, 1, 2. The idea is to put a clean box on first which has been thoroughly revivified, and which is therefore for a time extremely active in the absorption of sulphuretted hydrogen. During this period, the remaining boxes are found in practice to do as theory points out they should, and revivification in them progresses at a rapid pace. Some engineers prefer to alter the sequence at regular intervals—say, every 24 or 48 hours—the object in view, of course, being the same; and they have, I understand, obtained some very successful results by doing so.

In time it will obviously become necessary to change the oxide in one or other of the boxes; and a warning of this is given either by a box which is on first becoming fouled quicker than might be expected, and before the sulphided boxes in the series are sufficiently revivified to last any length of time when made first, or else by excessive pressure, which would indicate that the oxide is caking and otherwise obstructing the gas. The greatest efficiency can be obtained by working the boxes so that they are not recharged in the same order that they work in sequence. In other words, if it is necessary to recharge No. 1, then it should be aimed at making No. 3 the next box out. This can easily be arranged by working it more—thus enabling the old boxes Nos. 2 and 4 to have ample time for revivification, and so prolong their working life.

Purifying Results at Hampton Wick.

The four 30-feet purifiers at Hampton Wick were completed in December, 1908, and filled with oxide, each box holding about 75 tons; and gas was turned into them for the first time on Dec. 29. Since that date (28 months), they have been worked continuously on the reverse action system, the oxide in each box having been once changed. They still work satisfactorily, giving no more than about 2 inches of back-pressure for all four.

The change of valves—and hence alteration of the order of boxes—takes place each time a trace of sulphuretted hydrogen is found to be passing the sixth tray, as shown in the ordinary way by means of a lead acetate paper held in a stream of the gas for about half-a-minute; the total number of trays in the four boxes being twelve. In other words, as soon as foul gas is shown to be entering the third box in the series, then the fourth, or clean one, is made first in order of working, and is, of course, very active for some time in the absorption of sulphuretted hydrogen. The outlet of No. 2, which is now the third box, quickly gets clean, and soon after that No. 1 shows a clean test. The valve changes are naturally more frequent during the winter months, when the purifiers are doing most work.

The first change of valves was made on Feb. 9 (42 days after being turned into), by which time the trace of sulphuretted hydrogen had reached the sixth tray, and was entering the third purifier of the series. Now, had we been working in the old forward rotation way, it would have been necessary to have then changed the oxide in one of the boxes. Instead of this, a clean box was put on first, allowing the oxide in the remainder to revivify; and by the frequent repetition of these valve changes, we were able to postpone the recharging of a box until April, 1910 (thirteen months later), when back-pressure was given by the top tray of one of the boxes, making it necessary to lift the covers and recharge with fresh material. The cause of the pressure was found to be the caking of the oxide on the surface of the top tray, which was very hard, and had to be loosened by picks.

The amount of gas purified between Dec. 29, 1908, and April 26, 1910, was 244,782,900 cubic feet.

The other three boxes were not opened and recharged until the past winter, when it was deemed inadvisable to go through the period of maximum make with oxide of uncertain quality; and it also gave an opportunity of inspecting the interior of the boxes. There was, however, no trouble from pressure in them.

The oxide with which the boxes were filled in December, 1908, was a fairly good sample of natural bog ore; and, being a mixture of two parts new with one part old, it had approximately the following composition:

Moisture (dried at 212° Fahr.) 30 per cent.		
Purifying agent	57 per cent.	Dry basis.
Sulphur	17 ,,	
Alumina, &c.	1 ,,	
Fibrous and organic matter, &c. . . .	25 ,,	

When removed from the boxes for the first time, the composition was as follows:

No. of Purifier.	No. 1.			No. 2.			No. 3.			No. 4.		
Percentage of	Moisture.	Sulphur.		Moisture.	Sulphur.		Moisture.	Sulphur.		Moisture.	Sulphur.	
		Wet Basis.	Dry Basis.		Wet Basis.	Dry Basis.		Wet Basis.	Dry Basis.		Wet Basis.	Dry Basis.
Top tray . . .	13	51	58	7	51	55	5	53	56	8	54	58
Bottom and middle trays	5	45	48	5	43	45	3	38	40	12	46	52

The material from the bottom and middle trays was exposed to the action of the air for some time, and three batches have been replaced in the boxes, so as to be worked up to a higher content of sulphur. That from the top trays will not be used again, as in each case it contained over 50 per cent. free sulphur after the first fouling.

We do not work up the spent oxide for sulphur recovery; and owing to the system in vogue for disposing of our spent material, it has not paid us to work it up to a higher sulphur content than 50 to 55 per cent., because of the greatly increased labour cost of turning and refilling. But where it is sold to buyers of spent material, the higher the percentage of sulphur the greater is the price per unit received; and under such circumstances, the limit to which oxide may be worked under this system is not as yet definitely known. I had hoped to be able to give the amount of gas that the original 300 tons of oxide had purified, which cannot be calculated until the boxes are opened again—probably early next winter. But the fact remains that the 100 tons removed from the four top trays needed no revivification wages expended upon it—an item of about 2s. per ton each time that it is removed from the boxes for exposure to the air. During the whole of this period, the amount of air admitted equalled from 1½ to 2 per cent. of the gas purified.

It is, for obvious reasons, not usual with us, as a Junior Association, to go too closely into the monetary advantages of any particular plant or system; but I may mention that the purification wages per 1000 cubic feet for the past two years (during which time we have been working on the reverse action system) have been less than one-third of what they were previously. Moreover, there is no longer the continual worry of increasing pressures, frequent opening of purifiers and removal of oxide, and hourly tests of pressure and sulphuretted hydrogen traces, as was so essential with the old system. A daily record with gauge and test paper is all that is needed; and when it becomes necessary to lift the covers, they are always those of a clean box, so preventing complaints of foul smells from residents near the works.

By this system, as I have before mentioned, there is a large economy of labour. This is due principally to the greatly reduced number of times it is necessary to change the oxide in the boxes for revivification, since it is possible to work the oxide up to over 50 per cent. of free sulphur without removing it from the boxes—or, at any rate, with only one or two changes, instead of seven or eight as is usual with the old method. It also allows the oxide which is exposed to the air to be turned when most convenient with the labour available, since it is not necessary to turn it so frequently when once spread into a thin layer and broken up, owing to the length of time the purifiers last without being emptied, and to the fact that the oxide is partly revivified before being removed from the box.

Sulphided material is best heaped when first taken from the box, more especially if old, since the older the oxide the slower the

chemical action, and *vice versâ*. Consequently, precautions are necessary to prevent firing with new or artificial oxide. It should be remembered also that windy weather favours heating. If a temperature high enough to fuse the sulphur or drive off the water of hydration is reached, the oxide will suffer permanent depreciation as a purifying agent. Material containing a large percentage of clay and sand may with advantage be allowed to heat-up slightly; but care must be taken, as some varieties of sulphur fuse at a comparatively low temperature. If new, a day or two in heap is sufficient to start heating. But if old, the heap should be left a little longer; then broken up finely and spread into a thin layer, giving a swirling motion to the shovel, and so exposing to the action of the air the part of it which was previously underneath. When sufficiently turned and revivified, and likely to be required for use, it should be wetted down and brought to a heap. The various batches of oxide should be numbered, and an accurate record kept of their life and use.

An important point, worthy of note, is that it is necessary for some ammonia to be present in the oxide to keep it in the best condition for purification. Of course, I do not suggest that any ammonia should intentionally be allowed to pass the washers. The grain or so that escapes the washing and scrubbing plant is quite sufficient to keep the oxide in an alkaline condition. There is an absence of ammonia in oxide which has been used exclusively for oil gas purification; and I know of an instance where this caused the purifying action of the oxide to be very sluggish. When, however, it was sprinkled with ammoniacal liquor, a marked improvement was found. If separate purifiers are used for coal gas and oil gas, the difficulty can be overcome by interchanging the oxide.

All grids must be properly cleaned every time that a purifier is opened; and when filling a box a space of 3 or 4 inches should be left above the oxide in each tier, to allow for any increase in bulk which may take place as the proportion of sulphur increases. Otherwise there will be a gradually increasing pressure exerted upon the sides of the boxes. After the purifying material has been doing useful work in the purifiers without being changed perhaps for a year or two, or at any rate until it is charged with more than 50 per cent. of sulphur (as is possible with the reverse action system of working), it gets so large in bulk as to adhere most tenaciously to the grids and supports, and may at times make it necessary for the men engaged in emptying to resort to picks, which are not the sort of implements to extend the life of grids—ordinary or patent. For this reason, I should expect the ordinary flat pattern of grid to be more durable than many of the patent forms now on the market. With these forms, which allow the boxes to be almost completely filled with oxide, there is also a great risk of wet oxide not properly falling into place so as to entirely fill the spaces between the grids. When this oxide becomes dry, gaps are formed through which the gas slips; and it is not always possible to avoid wet oxide when revivification and filling have to be carried out in the open. One disadvantage of the flat pattern and a 12-inch layer of oxide is the liability of the gas to take a short-circuit where any inequality of filling may have caused a lessened resistance. This point only serves to emphasize the need of careful supervision during filling operations. Wood grids should, for preference, be made of an equal length to the side plates, and about 2 feet wide, for convenience in handling.

A large amount of condensation takes place in the purifiers. By downward purification, this condensation occurs chiefly in the covers, and dropping down should keep the material in good condition. With a crude gas, rich in sulphuretted hydrogen, this water may amount to a considerable quantity; for, according to the equations, we see the hydrogen contained in every 34 grains of sulphuretted hydrogen decomposed yields 18 grains of water. Half of this quantity is absorbed in the revivification process. The remainder has to be got rid of in some way. It contains little or no ammonia, and deposits solid matter on being heated. It is, therefore, of no value, and would not only act as a diluent if run into the liquor storage tank, but would probably cause some obstruction in the sulphate plant. The equations, of course, give only the quantity of water formed by theory during the purification process, to which must be added in practice the condensation of moisture that is held in suspension in the gas when it enters the purifiers.

In conclusion, I wish to express my thanks to Mr. W. E. Price, Assoc.M.Inst.C.E., for granting me permission to put these facts and figures before you.

Discussion.

Mr. C. Tanner (Gillingham) remarked that when one heard of so large an amount of gas being passed through purifiers without recharging, perhaps one was inclined to be a little sceptical. He would like to know what sort of grids the author used; and how the gas was conducted through the purifier. He could not quite see how he got the gas over the different tiers. Personally, he found with new oxide that it was generally better to put it in the carburetted water-gas purifiers first, and then bring it to the coal-gas purifiers. Air, of course, had been admitted into purifiers for some time past.

Mr. D. J. Winslow (Lea Bridge) remarked on the very small back pressure of 2 inches for the whole of the four boxes. This, he said, seemed rather extraordinary—taking it that the author meant all four boxes, and not each box. Mr. Scears was particularly fortunate in being able to put down four new boxes. In one part of the paper he mentioned that in many works the purifier connections seemed to be put down somewhat like a Chinese puzzle. But probably this was owing to the fact that alterations had from time to time been made in the mode of working, and the conditions had changed, so that additional connections had had to be put down. The author had good-sized boxes—30 feet square—and the gas passed through in sixteen months amounted to 244 million cubic feet, which would be about 190 millions in twelve months. At his own works, the boxes were roughly 20 ft. by 24 ft.; but there was considerably more than 2 inches of back-pressure—somewhere between 10 and 11 inches. While, however, his own boxes were only just over half the size of those at Hampton Wick, the gas passed through them was more than 200 million cubic feet per annum, as compared with the author's figure of 190 millions.

Mr. T. F. Canning (Ilford) said he also had been struck by the thought that they were fortunate at Hampton Wick in the fact that the putting down of the new boxes for the purifying plant synchronized so nicely with the introduction of this new system of working purifiers; and it occurred to him from the paper that Mr. Scears must have had considerable experience in purifying under this system with other boxes than these. It would be a valuable addition to the discussion if he could give some particulars of his experience with the former purifying plant at Hampton Wick. Companies adopting this system who already had efficient purifying plant could not afford to put down a new plant for the saving he showed. There was no doubt a saving by this system; but he ventured to say it would be a very small one when compared with the cost of extensive alterations to the existing plant. Mr. Scears mentioned that he had a portable gauge; but he took it there was also a battery of gauges permanently connected with the purifiers, so that any sudden increase of pressure would be notified. It seemed that a portable gauge might not be in the right place at the right moment; and something serious might easily happen on this account.

Mr. G. F. Cox (London) wished to know the maximum daily make, and whether the purifiers were used for simple coal gas or for a mixture of coal and water gas. With regard to the working of the current of gas downwards, he would like to know what was the condition of the oxide when removed, and if the author found that the moisture which came through with the gas got through the top layer and worked through all the intermediate and bottom layers. Then with reference to precautions taken on opening a box, before allowing the men to enter. Was there a tendency for the gas in the boxes to hang up in pockets? Did the author admit the air in the first place at the inlet to the exhausters, or did he admit it where necessary at each purifier? There were four covers to each box. Was there very much space between the covers and the sides of the boxes, so as to allow the men room for packing the oxide well back?

Mr. J. G. Clark (London) said he was pleased to have had the opportunity of listening to Mr. Scears' paper, and thought the purification processes were highly interesting phenomena—especially to a chemist. He was rather surprised to find an absence of quantitative data regarding the sulphuretted hydrogen at various parts of the plant. Sulphuretted hydrogen could be measured by simple apparatus, almost as easily as it could be detected by acetate of lead paper; and such measurements would be of great value in the study of systems like that described by Mr. Scears. Observations of temperature were often of great value in controlling purifiers; and as he noticed on the works record sheets which Mr. Scears had brought to the notice of the members a place for temperature observations, he would much like to ask the author if he had found them of any value. Would the author also please tell them where he admitted the 1½ to 2 per cent. of air to the boxes, and how it was measured? In regard to sulphur estimation, had Mr. Scears found it necessary to allow for any tar in the sulphur extracted by the carbon bisulphide? Sometimes the quantity of tar present was appreciable; and to get the correct figure for the sulphur, it was necessary to oxidize the extract and estimate the sulphur as barium sulphate. The oxidation could be done in various ways; but the use of bromine was simple and convenient. He noticed in the chemical equation in the paper that the formulæ were not strictly correct. Oxygen was diatomic, and should be represented by O_2. O_3 represented ozone. It did not, of course, affect the quantitative significance of the equations, and was very easily corrected by taking twice the quantities in each case

Mr. Winslow inquired whether any of the saving was due to starting off with good oxide in the first place. He had two parts of new and one of old in the four boxes. In comparing the cost of purification with this system and formerly, had the comparison been made with boxes starting off with the same proportion of new and old oxide? He would also like to know whether Mr. Scears had at any time found a sudden increase of sulphur at the outlet of the purifiers due to temperature or other causes.

Mr. E. G. Stewart (Kensal Green), referring to the better efficiency obtained from oxide when in an alkaline condition, said this was probably due to the presence of organic acids in the material preventing the chemical reaction of the oxide until these acids were neutralized, which, as the author had suggested, was effected by the grain or so of ammonia passing the washing plant. The similar phenomenon in the case of burnt oxide was due to an entirely different reason—namely, that in this case the purifying agent was $FeSO_4$, a product of excess oxygen in burning; and the ammonia or liquor (which was sometimes used) hydrated this into ferric hydrate, which formed the active purifying material. The efficiency of burnt oxide was entirely in proportion to the

percentage of sulphate it contained; the oxide itself not being in the hydrated state, and consequently inactive.

Mr. S. A. BEVINGTON (Croydon) asked if any tests had been made of the percentage of oxygen at various parts of the purifying system. Also what percentage of moisture on the average was in the oxide when put into the boxes. The lead paper would let one know that sulphuretted hydrogen was there; but it would not indicate whether the amount was 50 or 500 grains. At the works he was in, they did not ever find it necessary to change for foul oxide, but only for back-pressure. They could generally get 200 million cubic feet through 40 ft. by 40 ft. boxes before having to change; and he believed they had the lowest purifying costs per 1000 cubic feet of any works.

Mr. SCEARS, in reply, said he was gratified at the good discussion the paper had excited. It only emphasized the fact that, though oxide purification had been carried on for about half-a-century, the subject was one which even now was not properly understood, and in connection with which there were great opportunities for research work and for improvements. He would endeavour to answer the points that had been raised. The grids used were the ordinary flat pattern, just as shown on the plan. The gas went in at the top of the purifier, and over the whole of the surface of the oxide on the top tier, and worked its way down gradually through each tier to the bottom. There was no special arrangement for conducting the gas over the whole area of the purifiers, such as was the case with some patent forms of grids. The system of working could be adopted with any ordinary purifying arrangements, provided they had valves—such as the Weck valve, or ordinary slide valve—with which they could work the purifiers in any consecutive order. The comparison of costs extended over four years. Of course, he was not in a position to give actual figures; but they were fairly regular over each half year. Previous to 1908, the purification labour costs were about three times as much as they were now; and the economy was entirely due to the lessened number of times oxide in purifiers had been changed, and to almost entire absence of revivification wages. The 2 inches back-pressure was for the whole of the four purifiers; and the smallness of the figure was no doubt due to a very great extent to the large area of the boxes. It had been proved beyond dispute that the slower the speed at which gas travelled through the purifiers, the more complete and economical was the purification. But the success of this system was not due entirely to the area of the purifiers. When they made the first change of valves, 42 days after turning into the purifiers, the trace of sulphuretted hydrogen had reached the sixth tray, and was entering the third purifier of the series. If they had been working on the old system, they would have had to change a box then, irrespective of the area of the boxes. But by changing the valves, and putting a clean box first, and working on the reverse action system, they were able to postpone the change of the purifier for a considerable period afterwards. The order of working was changed thirteen times before it was found necessary to recharge a box. He had never found sulphur to be sent forward from the purifiers because of an increase of temperature, though they did not have a sulphur test on regularly, because they had no legal limit to the amount of sulphur compounds, other than sulphuretted hydrogen, in their purified gas. They did, however, have a Referees' sulphur test on occasionally; and a test comprising lead acetate papers on which a jet of gas impinged was kept in use continually on the outlet of the purifiers. But it was quite possible for a sudden rise of sulphur compounds to take place with oxide containing a large amount of sulphur, when there was an increase of temperature due either to summer or the action of revivification. The free sulphur in the oxide absorbed CS_2, which it again liberated upon heating. Mr. Stewart had put forward a theory about the organic acids in oxide interfering with its power of absorbing the sulphuretted hydrogen. There had been some interesting experiments published which were carried out by Mr. Shadbolt, proving a greatly increased duty from oxide kept in an alkaline condition. There were several theories as to why this was so; but he believed the correct explanation was that when gas was slightly alkaline the reaction between sulphuretted hydrogen and oxide of iron produced ferric sulphide; and this rapidly revivified on exposure to air. But if the gas was neutral, or even slightly acid, or should the oxide contain some organic acids as suggested by Mr. Stewart, then the oxide was converted partly into iron pyrites, which did not revivify into an active purifying agent. There was no battery of gauges fixed up; but any sudden increase of pressure would be shown on the gauge in the exhauster-house at the outlet of the exhausters, which was watched constantly by the attendant. A record of temperatures and pressures was taken each morning; and any change would be quickly noticed by the man in charge. In only one case had they had an increase of pressure (which was referred to in the paper); and then it was merely on the surface of the top layer of oxide. There was no gas hung up underneath it. Directly the covers were taken off, the whole of the gas came out of the purifier. The boxes were used for coal gas only now, because they had separate purifiers for the oil gas; but for about a month or two, they were used for coal gas and oil gas. The maximum amount of gas purified in 24 hours was about 850,000 cubic feet. The condition of the oxide when removed from the boxes in each case had been very dry right through all three trays, as they would see from the table in the paper. In only one instance was it hard; in the others it had been quite powdery. The space between the covers and the sides of the boxes was about a foot; and there was plenty of room for the oxide to be pressed down at the sides, and so prevent the gas getting through. He had not a complete record of tests for sulphur and oxygen throughout the purification system; but the sulphur at the inlet of the purifiers would be about an average of 450 grains, and at the outlet just over 30 grains. He would like to emphasize the valuable service which simple lead acetate papers were able to render, since they would in a second or two reveal the presence of less than a grain of sulpuretted hydrogen per 100 cubic feet. He had never found any tarry matter in the oxide from these purifiers, but he had in oxide from oil gas purifiers—especially in the bottom tray. He acknowledged that one of the equations should be expressed differently. The whole equation ought to be doubled, so as not to have the O_2. There were a lot of experiments which might be carried out in connection with purification systems which would be exceedingly valuable. There were many points which still remained to be cleared up. And the matter referred to by Mr. Bevington would form a most interesting series of experiments. Not being in a position to give exact figures about purifying costs, he was not really able to dispute Mr. Bevington's claim on this head. The air was drawn in at the inlet to the condensers, where the gas was at a temperature of about 100° Fahr. It was not measured continuously; but the quantity was regulated by a cap with a small hole in it. Occasionally a meter was fixed up, and the percentage of air being used calculated.

Mr. CANNING asked whether the author could, in connection with his experience with old purifiers, give the area of the boxes, and some account of his general experience when working this system with the old purifiers. In the majority of works at the present day, he pointed out, this system, if introduced, would have to be worked with existing purifiers; and a few points on the matter would be an advantage.

Mr. SCEARS replied that they did experiment with this system for some years with other purifiers, and obtained very successful results. They were of smaller area, and the gas was admitted at the bottom; and, of course, it was then both oil gas and coal gas that went through the purifiers. The principal difficulty they found with these purifiers was pressure thrown in the bottom tray, where the gas went between the wood grids and met a small area of oxide. But when the gas was allowed to go in at the top, as with the new purifying plant, it came in contact with a big area of oxide over the whole surface, and therefore there was less chance of pressure being thrown where the gas first met the oxide. The early experiments showed there was something in the system; and, when new purifiers were erected, so that coal gas and oil gas might be purified separately, it was decided to work both plants continuously on the reverse action system, and they had effected considerable economy by so doing. The old boxes were 20 feet square, and were now used entirely for oil gas.

Mr. CANNING proposed a hearty vote of thanks to Mr. Scears for his paper, which had no doubt entailed a tremendous amount of work. It formed a small treatise upon this method of working purifiers. The paper would be most useful for reference.

Mr. TANNER, in seconding, remarked that though he used oxide of iron he certainly did not get the results mentioned in the paper; but he could not with his system of purification do what they could at Hampton Wick, where they had a very big area. He did not suppose that the large London works had anything like the area proportionately that they had at Hampton Wick.

Mr. W. J. LIBERTY supported the vote; pointing out that the author was called upon rather hurriedly, and very willingly filled up a gap in the programme. Mr. Thorp was to have given them a paper, but was unable to do so; and so Mr. Scears came forward. In every way the paper was good.

The PRESIDENT (Mr. L. F. Tooth) also said Mr. Scears had done full justice to his subject, though the paper was prepared at short notice.

The vote having been carried with applause,

Mr. SCEARS acknowledged it, and said he was very glad to be able to come forward and fill the breach, especially as he felt that a paper on a manufacturing subject would be acceptable to the members. He was afraid the paper did not contain anything very new or startling; but amid great similarity there might yet be great differences. He hoped that his effort would induce some other members to come forward with papers on manufacturing subjects.

[Mr. Scears exhibited drawings relating to the purifying plant at Hampton Wick, and mounted photographs taken by him during the erection of the purifiers—among them being those now reproduced. He also had several interesting models.]

Gas Heating-Stove Competition in Paris.—We have received from the Managing-Director of the Paris Gas Company (M. Rouland) a letter intimating the intention of the Company to open this year a competition of appliances for heating apartments, especially small installations. The competition will be held under the supervision of a Committee composed of representatives of the Company and the Société Technique du Gaz; and a sum of 5000 fs. (£200) has been placed by the Company at their disposal for the purpose of making awards. As the competition will be open to the manufacturers of appliances of all countries, those of our readers who wish for information as to the conditions should apply direct to the Société du Gaz de Paris (Service Central des Abonnés), 6, Rue Condorcet, Paris, and they will be furnished with a programme.

BIRMINGHAM COAL TEST PLANT.

By W. B. Davidson, D.Sc., and G. C. Pearson.

[A Paper read before the Midland Junior Gas Association, April 27.]

Results of experiments in carbonization on the Birmingham coal test plant were published last year. It is our intention in the present paper to supplement those results, and more particularly to give an account of practical methods of working.

Shutting-Down of Plant.—It is the practice in Birmingham, as in many other places, to shut-down gas-making plant for two eight-hour shifts on Sundays. It will probably be of interest to many of our members if we state the rules which have to be observed on the Saltley test-works in so doing. They are as follows:

1.—The last charge is put in at 5 o'clock on Sunday morning. At 8 o'clock, all sludge cocks on the hydraulic mains are opened, if previously closed, so that the seal is regulated from the tar-tower. The weir-valve on the tar-tower is raised to a height of 1½ inches, which in our case ensures a seal nine-tenths in depth. Should the period of shutting down be more than one day, an extra ½ inch of seal is put on.

2.—At the same hour, the pressure at the inlet of the retort-house governor is adjusted to level gauge, and kept so until the hour of shutting down. This ensures that furnace gases are not drawn into the retorts during the fag end of the gas making.

3.—Gas is exhausted from the retort-house until the make is not more than 500 cubic feet per hour—that is, less than 4 per cent. of the normal production. This usually happens at 10.30 a.m. The exhauster is then stopped; the inlet and bye-pass valves to the air condensers are closed; and the bye-pass valves to the other apparatus, with the exception of the purifiers, are opened. The cocks on the gauge-glasses of the station-meter are closed.

4.—The retort-house liquor supply-tank is filled, and liquor is left running slowly into the hydraulic mains to ensure maintenance of seal.

5.—After the last charge is put in, the position of the primary and secondary air slides is chalked upon the boxes, that they may be raised to a similar position on starting up. The primary slides usually work at 2½ inches, and the secondary at 1½ inches. Of the two primary air slides, one is closed entirely and the other left open to the extent of ⅜ inch. All the secondary air slides are reduced to an opening of ⅜ inch. The main damper is dropped from its usual position of about 24 inches to 6 inches. The bed dampers are left unaltered.

6.—Producer fires are filled, and care is taken that water is dripping on to the fire-bars. The fires are fed with cold coke every six hours.

7.—Syphons are pumped; meters are water-lined; retort-house governor steamed; and plant generally overhauled—the valves in particular being tried for smooth working.

Starting-Up.—The foreman comes in two hours beforehand, and the following rules are observed:

1.—All syphons are examined, and pumped if necessary.

2.—Air slides on the settings are set to their correct working positions. The main damper is set at 26 inches.

3.—The weir-valve on the tar-tower is altered to 1 inch, and liquor kept overflowing. This gives a liquor seal of 4-10ths.

4.—Two retorts are charged, and the effect noticed on the gauge at the inlet to the air condensers. When the pressure rises to about 3 inches, the exhauster is started slowly; the pressure at the inlet to the retort-house governor being meanwhile maintained at level gauge, giving a pressure of about 4-10ths in the retorts. Weights are gradually adjusted on the retort-house governor during the first six hours, until a vacuum of 4-10ths in the inlet is reached. No further change is made except under special conditions; the pressure in the retorts being kept at level gauge during ordinary working.

5.—As soon as the exhauster has begun to work smoothly, the bye-pass valves to the different apparatus are shut, one after the other—pressures being watched meanwhile. The gauge-cocks to the station-meter are opened, and a small dribble of water is left running in to maintain the water-line.

It would be interesting to discuss at length the losses that are undoubtedly sustained by a gas undertaking owing to cessation of gas making on Sunday. These are mainly—

1.—Interest and depreciation on additional capital outlay.

2.—Increased labour for firing and attendance.

3.—Extra expenditure of fuel for heating retorts.

4.—Increased wear and tear on settings.

There is no appreciable gain or loss in gas production. The gas made on Sunday morning from 8 to 11 o'clock—called "burning-off" gas—is, however, of so poor a quality as to necessitate its being stored separately, either for subsequent enrichment with carburine, or for admixture with "starting-up" gas, which is invariably of high quality. The larger yield of gas per ton of coal obtained on Sunday morning sets off the smaller yield on Sunday night or Monday morning; but although an approximate balance is thus effected, there is not infrequently some difficulty in securing proper mixing and distribution of town gas at the beginning of the week. A full consideration of this side-issue would here be out of place.

Coal.—The coal is weighed in trucks, gross and tare, to the nearest 7 lbs. on an accurate weighbridge; the weighings of the clerk being checked by the chemist on duty. The figures agree closely with the invoice weights sent from the collieries, as the following consignments for one quarter indicate.

Consignment.	Invoice Weights. Tons.	Works Weights. Tons.	Excess Weights. Per Cent.
1	68·25	68 9	1·0
2	145·15	146·5	0·9
3	177·8	178·95	0·6
4	67·15	68·35	1 8
5	73·25	73·9	0·9
6	150·9	152·2	0·9
7	69·85	70·4	0·8
8	78·85	79·15	0·4
9	232·15	230·75	−0·6
10	75·95	76·8	1·1
11	78·6	79·95	1·7
12	180·3	180·1	−0·1
		Average	0·8

The coal is unloaded into bogies, and elevated by hydraulic lift to the storage hoppers, of which there are eight in the retort-house; separate hoppers being reserved for each truck load. The charges are weighed out to each mouthpiece over two half-ton weighing machines. They usually average 6½ cwt., and are graduated to top, middle, and bottom retorts—the first-named getting 7 cwt., and the last 6 cwt. In this way, it is found possible to keep very even temperatures in the several retorts and to carbonize the coal to better advantage. Should the coal be very wet or contain a large percentage of dust, the weights of the charges are reduced so as to allow the distillation temperature to remain fairly constant—that is to say, in the neighbourhood of 2000° Fahr. in the interior of the retort at the time of discharge. The period of distillation for the above charge is six hours; three retorts (top, middle, and bottom) out of the eighteen being charged each hour. At least 60 tons are carbonized for a test.

The method of arriving at the total weight used is as follows: A start is made with a particular hopper of coal—the contents of a certain truck. Six hours are allowed to elapse to give sufficient time to charge all the retorts with the coal under test. Meter readings and stocks are then taken; and the test is begun. The quantity used during the preliminary period of six hours is given by the small weighing machine, and is deducted. It is arranged to finish the test just as a hopper is nearly emptied of its contents; the surplus being weighed over the half-ton machines. Otherwise the weighings of these small machines are merely used for the purpose of measuring the separate charges for the retorts, and not for determining the total weight carbonized during the test. In charging—which is done by hand shovel—large lumps are not allowed to be thrown into the retorts, as such a practice has been found to cause unevenness of charge and to injure the retorts. The use of water for damping the coal to keep down flares is not permitted. Any tar accumulating on the mouthpieces or removed from the ascension-pipes is raked upon the charges, and so put back in the retorts. No allowance is made for moisture in the coal as consigned, although this is sometimes rather variable. An exception is made in the case of stack coal, which generally contains as much as 8 to 10 per cent. of water. In this case, the net weight is calculated on a basis of 3 per cent. of moisture.

In very few instances has the quality of different kinds of coal consignments shown distinct signs of deterioration; and in more than one case the depreciation has been due to the presence of an excessive amount of moisture, arising no doubt from some local peculiarity of the coal-seam. As stated in a previous communication, the depreciation in gas production resulting from the storage of coal is found to be not more than 2 per cent. per annum. It must be remembered, however, that gas coal stacked in the Birmingham works is for the most part large and moderately hard. The figure accepted in Germany is 7 per cent. depreciation per annum on English coal stored in the open, 4 per cent. in covered stores, and on Saar coal 3·3 per cent. and 1·6 per cent. respectively. The English coal used in German gas-works, however, comes almost entirely from the Durham district, and consists largely of nuts and dust, and is therefore more liable to undergo decomposition.

Uniformity of Gas.—It is the natural aim of the gas engineer to produce gas of uniform quality, which suits the needs of the consumer and is at the same time economical to manufacture. On the coal test plant, we are fortunately placed in knowing the coals that we are dealing with. Having three influencing factors to manipulate—namely, retort temperature, weight of charge, and pressure in retort—we do not find it very difficult to maintain any desired illuminating power within the range of 14 to 17 candles as measured by the No. 1 argand burner. Uniformity in illuminating power, however, is in most cases more troublesome to achieve than is constant calorific value, for the good reason, among others, that carbon dioxide and nitrogen drawn in from the furnaces have a powerful effect on the candle power. Difficulties

in the arrangement of labour preclude us from taking advantage of another influential factor—duration of charge. It is possible to get widely differing yields of gas from the same coal by altering the conditions mentioned. For example, the following test figures were obtained from the same coal.

Make. Cubic Feet. Per Ton.	Illuminating Power. Candles.	Calorific Value. B.Th.U. Net.	Test Conditions.
1.—11,220	16·58	552	Heavy charges. Level gauge.
2.—13,600	13·53	485	Very light charges. Level gauge. High temperature.

The following series of tests may be taken as representative of the uniformity of results obtained in carrying out a test:—

Sample Collected.	I. P. Candles.	C. V. B.Th.U. Net.
10 p.m.—5 a.m.	15·20	512
6 a.m.—1 p.m.	15·60	529
2 p.m.—9 p.m.	15·70	539
10 p.m.—5 a.m.	15·60	522
6 a.m.—1 p.m.	15·95	530
2 p.m.—9 p.m.	15·70	528
10 p.m.—5 a.m.	15·60	528
6 a.m.—1 p.m.	15·45	523
Average	15·60	526
Maximum deviation	0·40	14

Needless to say, daily inspection of the combustion chambers, retorts, and flues, and measurement of retort temperatures, are all necessary to make it possible to keep the retort-plant attuned to the proper pitch. Air-slides and dampers are regulated according to the nature of the coal about to be tested. The settings respond in a few hours to alterations.

It may be of interest to record our experiences with devices for aiding the gas engineer in maintaining uniformity of quality and obtaining the most from the coal.

Jet photometers of the usual pattern have been used on the test works, but with slight advantage. This instrument is of little value on a test plant. It can only show large variations in illuminating power. Of more practical use is the recording calorimeter. The instrument we have employed is the Beasley patent, made by Messrs. Parkinson and W. & B. Cowan. For so simple a mechanism, the results are wonderfully accurate. The scale is a very open one; and therefore slight alterations in pull, variations in gas due to charging, changing of purifiers, and such like, are shown up very distinctly on the recording sheet. It is necessary, of course, to apply corrections for temperature and pressure of the gas. The following diagrams illustrate the effects referred to.

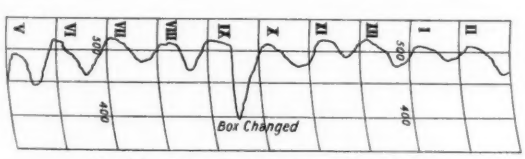


Chart I.—Three Retorts Charged per Hour.

A comparison of the relative accuracy of the jet photometer, on the one hand, and the Beasley recording calorimeter, on the other, is afforded by the table below, where the figures represent the results of twelve consecutive shift tests. The argand burner and Junkers calorimeter tests were carried out on the ordinary samples of gas collected uniformly throughout each shift; and the figures for the jet photometer and recording calorimeter are the average readings for the corresponding periods.

Different Coals in Use.	I. P. Corr. t. & p.		C. V. Corr. t. & p.	
	No. 1 Argand.	Jet.	Junkers Clmtr.	Beasley Rcdr.
1	16·15	15·8	554	535
2	16·10	16·2	540	533
3	16·05	17·4	531	546
4	16·10	17·0	534	556
5	15·55	14·6	502	504
6	15·00	14·6	527	518
7	15·00	15·8	514	501
8	15·50	14·2	537	527
9	14·60	15·8	536	528
10	15·40	15·0	509	515
11	15·20	15·4	523	531
12	14·90	14·2	515	522
Average	15·45	15·5	527	526
Max. deviation, p. ct.		8·4		4·1
Aver. deviation, p. ct.		4·7		2·0

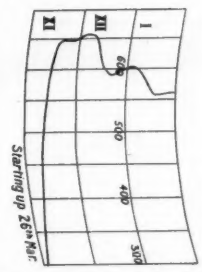


Chart III.—Starting-Up Plant.

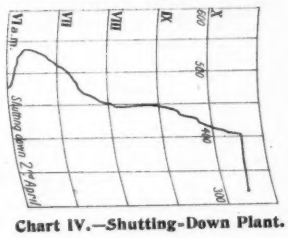


Chart IV.—Shutting-Down Plant.

CHARTS FROM BEASLEY'S RECORDING CALORIMETER.

Retort-House Governor.—The retort-house governor installed was, until recently, of the earlier type of Carpenter governor, supplied by Messrs. Parkinson and W. & B. Cowan. It has since been converted by this firm to the newer counterbalanced type, with improved results. The advantages of this newer form are obvious, on consideration of the sketches.

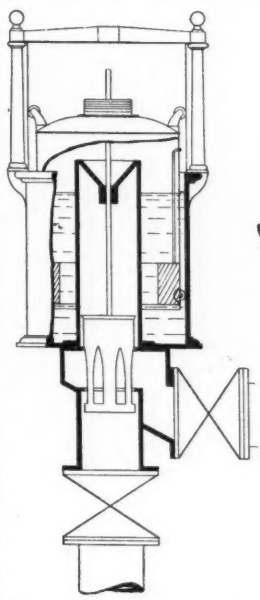


Fig. 1. Retort-House Governor. Earlier Type with Floated Bell.

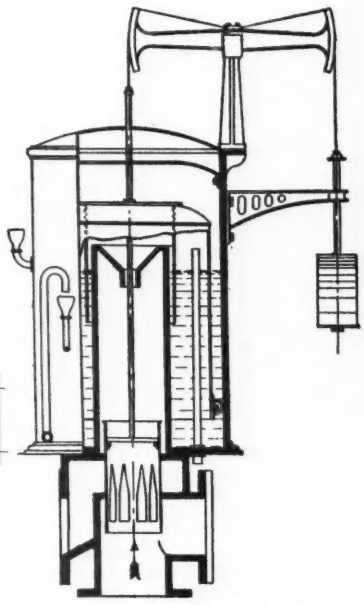


Fig. 2. Retort-House Governor. Later Type with Counterbalanced Bell.

It will be noticed that, in the earlier type, the inlet and outlet pressures act upon the bell through the valve simultaneously and through the same passage-way. In the newer type, the inlet pressure has an effect quite distinct, by means of a pipe leading from the inlet side to a chamber partitioned off in the bell. Furthermore, the fact of the weight of the bell being counterbalanced, and not floated by air chambers, leaves it much more freedom of movement—there being far less surface exposed to the resistance of the tank-water. Again, in the older type, tar is likely to settle out in considerable quantities down the sides of the bell, collecting upon the top of the air-chambers—thus weighting and interfering with the balance. In the newer pattern it is important that the pressure pipe from the inlet side should be of a good size, that it may not be stopped with tar. At the same time, it is well for the end under the bell to be fitted with a cap containing a small orifice, so that a momentary inlet oscillation shall not act with too sudden a force and cause a recoil upon the balanced arm, the swing of which would take some little time to settle down.

On p. 310 are reproduced prints of two average charts from a Thorp's register at the inlet to the retort-house governor, which clearly show the improvement obtained from the installation of the newer type of governor.

It is much better to set a retort-house governor upon the top of a foul main, so that the gas may rise through it, than to place it in the straight-through principle as at the coal-test plant. In the former position the gas has a more direct passage, and, more important still, no tar deposit can accumulate in the casting under the valve. In the straight-through type, this almost invariably

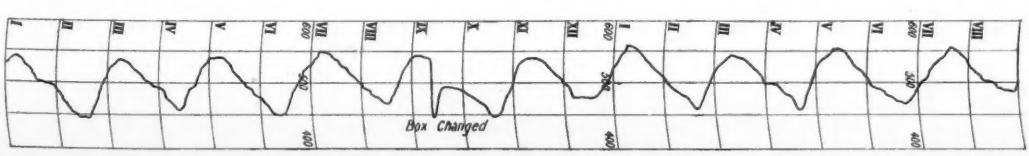


Chart II.—Six Retorts Charged per Two Hours.

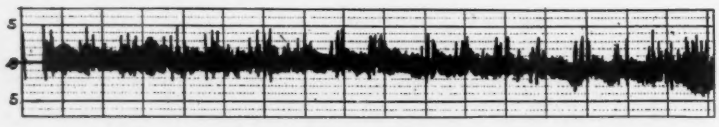


Chart V.—Retort-House Governor—Floated Bell.

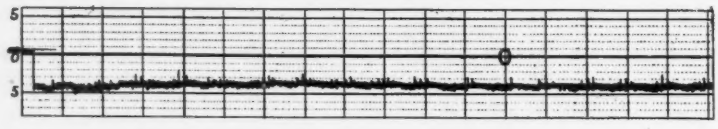


Chart VI.—Retort-House Governor—Counterbalanced Bell.

occurs, with the result that the valve when fully shut is immersed in 1 to 2 inches of thick tar, the effect of which is to impede the free and proper action of the valve. A good means of preventing such a deposit is to fix a simple open U syphon in the casting under the valve, and thus automatically drain away the tar before it can accumulate.

As an illustration of the above, it may be of interest to quote a recent experience. A special test was being carried out which involved a large make of gas per hour, tailing off to a very small one. As the flow of gas grew less and less, the working of the governor became more and more erratic, until eventually it stuck; the tank water being then drawn over into the main, unsealing the bell. On investigation, an accumulation of very thick tar was found under the valve, which was thus prevented from sinking to accommodate itself to the small flow of gas, and allowed the 6 inches of "pull" maintained on the exhauster to act with full force under the bell. [It should be mentioned that the level of liquor in the hydraulic mains was such as to prevent the continuous use of the U tar-syphon already referred to.]

Owing to the restricted area of gas passage in a governor, there is required a greater pull at the outlet side than at the inlet side; and up to a certain point, the greater the pull the more evenly does the governor work. The exhauster pull maintained at the coal-test plant is from 4 to 6 inches; and so long as an even pull is maintained at the inlet to the retort-house governor, a little oscillation in the mains leading to the exhausters cannot be any disadvantage.

The exact extent of improvement in gas production brought about by the alteration in the governor cannot be stated. It is probably not more than 1 to 2 per cent. In a previous paper, one of us published results of investigations which pointed to 2 per cent. improvement. This figure is now, for the better type of governor, to be increased to (say) 3 per cent., which is equivalent to a gain of nearly half a candle. The mechanical arrangement on the exhausters on the Birmingham test plant is unsatisfactory, and leaves considerable room for improvement. It may well be that on other works, where the exhausters work with quite steady pull, there is no great need for a retort-house governor.

Effect of Alterations of Pressure.—As already stated, it is our custom, in the majority of coal tests, to set the retort-house governor to maintain as nearly as possible level gauge in the retorts. We have found considerable variation in the percentage of furnace gases in the coal gas made, even when conditions seemed quite normal. It is, of course, the difference in pressure between the fire gases surrounding the retorts and the coal gas inside the retorts that counts. The former is usually not more than one-twentieth of an inch pressure, but is more or less affected by strong winds. Another factor is the condition of the retorts with regard to leaks. The importance of having the retorts covered with a coating of retort carbon is made manifest by the following results, which at the time came rather as a surprise. On restarting the plant after renewal of retorts on one occasion, advantage was taken of the heating-up period to start a low-temperature test, imitating coalite conditions. Instead of obtaining 18 to 20 candle gas, as expected, we were astonished to get only half that figure. Complete gas analysis disclosed the presence of an appalling amount of nitrogen, and this despite the fact that we were carbonizing at level gauge.

Conditions of Working.

Retort Temperature.	Pressure in Retorts.	Make Cub. Ft. per Ton.	I.P. Candles.	C.V. B.Th.U net.
1200° Fahr.	Level gauge	About 2000	10·90	455

Gas Analysis.

CO_2.	O.	CnHm.	CO.	H.	CH_4.	N.
5·35	0·45	3·65	7·90	27·7	32 0	22·95

On this occasion, although all the retorts were coated with Korktite cement, no gas was registered for eight hours after the whole eighteen retorts were charged. The charges were 6 cwt., and some tar was added for the purpose of helping to seal the retort pores and joints. The make of gas per ton for the first 24 hours was only some 2000 cubic feet.

The normal percentage of nitrogen in the coal gas made on the test works when carbonizing at level gauge is about 6 per cent., only one-fifth of which, by the way, is actually distilled from the coal.

It is the practice at one of the Birmingham works to alter the pull of the exhauster (no retort-house governor is used), so as to give 2-10ths vacuum in the retorts immediately after charging is completed. This is continued until the next draw, during which 2-10ths pressure is maintained; the retorts being charged every two hours. The results appeared to be good, and a similar method was accordingly tried on the test plant. Comparative tests of one week's duration, however, showed no advantage in favour of the intermittent system of governing pressures. [For results, see table at foot of page.]

Anti-Dip.—It was found advisable to cut out the first anti-dip installed, and put in a system which did not possess the faults of the old one, and allowed of more latitude in changes of working such as are required at a testing plant. The anti-dip installed is shown in the sketch. It consists of an inverted cast-iron cone suspended beneath the dip-pipe. The cone is capable of being raised to seal the pipe, or lowered to unseal it, as required. It is necessary, of course, for the inside of the bottom of the dip-pipe to be turned true, and it should form a sharp edge for the cone to seat upon. The cone is cast with an inside partition, which is drilled and tapped 2-inch gas. A rod, having the end forged to a round knob, is threaded through the cone; a plug being screwed in

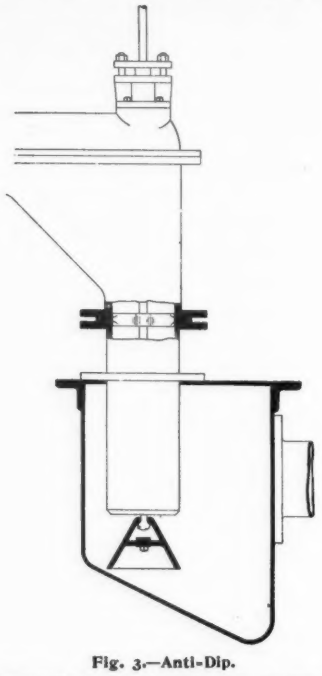


Fig. 3.—Anti-Dip.
Section through Hydraulic Main showing Sealing Cone, &c.

this partition. This device ensures a joint that is gas-tight and yet capable of movement similar to a ball-joint. The rod passes up the centre of the dip-pipe through a stuffing-box in the H pipe, a pair of jaws being screwed upon the top end. A pin across these jaws passes through and slides in a slotted hole in the arm of a lever moving on a bracket carried by an angle iron supported parallel to and above the hydraulic main. A weight is fixed upon the arm, ensuring that the anti-dip is at rest with the dip-pipe open. To the other arm of the lever is attached a rod, which hangs down to the charging stage, fitted with a loop at the lower end, to which

Effect of Charging Six Retorts every Two Hours, with Increased "Pull" while Retorts are Closed, compared with Ordinary Working.

Conditions of Charging.	Duration.	Vacuum at Inlet to Retort-House Governor.		Weight Carbonized per 24 Hours.	Retort Temperature.					
		During Time of Charging.	Lids all Closed.			Make Cub. Ft. Per Ton.	I.P.	I.P. Multiple.	C.V.	C.V. Multiple.
	H. M.			Cwt.	Deg. Fahr.					
Three retorts per hour .	6 0	−0·4"	−0·4"	25·32	2000	12,020	16·51	198,500	536	6,440
Six retorts per two hours	6 0	−0·4"	−0·6"	25·68	2045	12,040	16·42	197,700	534	6,430

may be attached a further weight sufficient to actuate the lever, and raise the cone, thus sealing the dip-pipe. It is found advisable to fix one guide in the joint of the H pipe and dip-pipe, to prevent swing and strain of the rod carrying the cone. This guide should give at least $\frac{3}{16}$ inch clearance for the passage of the rod, otherwise sticking from the accumulation of tar will take place. The stuffing-box should also have $\frac{1}{8}$ inch clearance, and be packed with one round of $\frac{1}{2}$ inch grease packing. This form of anti-dip has the following advantages.

1.—It is entirely self-contained, its action being independent of the gas plant—no liquor or gas pressure being required.
2.—It permits of working with a dry main continuously, liquor and tar draining away as fast as they are deposited.
3.—It does not seriously curtail the capacity of the hydraulic main, as do some well-known anti-dip devices.
4.—It is simple in design, easy to construct, and requires little attention.
5.—It is an anti-dip fitted to each separate dip pipe.

It possesses a disadvantage, inasmuch as the sealing may be rendered imperfect by the presence on the cone or dip-pipe of hard or gritty matter. The risk of such a trouble is no doubt more pronounced when working with a continuous dry main, as at other times the cone is immersed in liquor. This difficulty is probably of very rare occurrence. We have experienced no trouble of this kind hitherto. Moreover, a perfect gas-tight joint is not often required, as the general practice is to work with level gauge in the retorts. We have on several occasions discharged and charged retorts in the absence of seal of any kind, taking care to maintain an exact level gauge at the inlet to the retort-house governor.

Tests planned with the object of ascertaining what advantage in gas production, if any, is gained by the improved anti-dip over a light seal, have not yet been completed. There would appear to be only a very slight gain. It is important to note that when the anti-dip is used, careful governing of pressures is still more essential to good working than when the dip-pipes are sealed.

Tar Seal.—It is the practice at some works (at the great minority, we believe) to seal the dip-pipes with tar instead of liquor; and an experiment was made to ascertain the effect of such a seal upon the quality and composition of the gas. The hydraulic mains and tar-tower were accordingly run off dry; the anti-dips being used meanwhile. The sludge-cocks on the hydraulic mains were then closed, and tar was run into the mains from the retort-house tank. The bed gas weir-valves were set to give a seal of 0·4 inch on the dip-pipes; the surplus tar overflowing over these valves into the foul main, and thence into the tar mains. This method of maintaining the seal ensures that the tar is not displaced by water condensing in the hydraulic main, as there is a continual flow from the surface over the weir-valve to equalize the constant feed of tar from the retort-house tank.

Effect of Working with a Tar Seal.

[A seal of 0·4 inch was maintained in both cases. Same coal used throughout.]

Temp	Weight Carbonized per 24 Hours.	Seal.	Vacuum inlet to Retort-House Governor.	—					Naphthalene Grains per 100 Cub. Ft.
				Make.	I.P.	I.P. Multiple.	C.V.	C.V. Multiple.	
Deg. Fahr.				Cubic Feet.	Candles.		B.Th.U.		
2025	25·85	Liquor	−0·4″	11,760	15·90	187,000	530	6230	2·3
2025	26·04	Tar	−0·4″	11,450	16·16	185,000	540	6180	1·0

Coke.—The coke is drawn from the retorts and dropped into the cellar, where it is quenched and loaded into bogies. The bogies are run on a light rail to a coke loading-stage, where the coke is forked into trucks with twelve-tine forks. Particular care is taken that the coke is well forked, as upon this depends the estimation of percentage of breeze and dust. The trucks are weighed in a similar manner to the coal trucks, as required and at the commencement and finish of tests. It will perhaps be noticed here that the first six hours' make of coke will not be from coal actually included in the test proper—the charges taking six hours to carbonize; but as the charges are constant, no error of consequence can thus arise.

Fuel.—The fuel used is calculated as a percentage on the coal carbonized, in the following manner. A number of weighings are taken during a test of the yield of coke hot, direct from the retorts; great care being exercised over the weighings, in the first place, to see that the coal is correctly weighed and thrown into the retorts without loss, and, secondly, to see that no coke is lost. From these weighings, the percentage of total coke on the dry basis is obtained. Coke is used direct from the retorts for the fires as required, and the remainder loaded into trucks; an average sample being carefully taken in air-tight iron bins. This sample is tested for moisture, and the weight of loaded coke, or sales, corrected to the dry basis. To this is added the weight of coke picked from ashes from the fires. The difference between the percentage of total coke and that of dry coke sold is the percentage of dry fuel.

Clinker.—The clinker taken from the fires is weighed and recorded as a percentage on the fuel consumed.

With the exception of cannel and two or three consignments of slack containing abnormal amounts of ash, all the coals tested produced coke capable of supplying the necessary heat to maintain retort temperatures of over 2000° Fahr. In one or two cases where the contrary was suspected, prolonged tests were made to satisfy ourselves on this point. With the settings at the test plant, we believe it possible, indeed, to melt a Stourbridge material with the coke from any of the ordinary gas coals.

Estimation of Tar and Liquor.—In the estimation of tar and liquor there is great possibility of serious error, if attempts are made to measure and sample the contents of the various apparatus and tanks separately. This is, perhaps, more pronounced in the case of tar, which has a comparatively small volume, and separates itself from the liquor slowly and incompletely. On the test plant, there are two wells, each of about 1200 gallons capacity, having inlet-valves from the liquor mains, and two overhead sales tanks. Before the commencement of a test, one of the wells is pumped quite dry into the sales tanks, the liquor and tar from the various apparatus meanwhile working into the other well. At the start of the test, all the apparatus, including the hydraulic mains and tar-tower, are "run off" completely into the working well, and the apparatus is refilled with clean water. Thereupon the wells are immediately changed over; the apparatus then working into the empty well, the other well being pumped to the sales tanks. It will be seen that by this simple method it is possible to collect the total make of tar and liquor in the sales tanks for each test. These tanks are left to stand for 24 hours before dipping, this being sufficient time in most cases to allow the tar to settle. With certain coals making light tars, trouble is experienced in obtaining a good line of demarcation between depth of tar and liquor; but, as a rule, a good clear line is obtained, the readings of two persons agreeing to less than $\frac{1}{2}$ per cent.

The method of dipping adopted is to drop a quarter rod lightly smeared with paraffin vertically over a particular spot of the tank where a plate is fixed upon the bottom. The rod is twisted round for some little time, and the total dip and tar dip then measured. Duplicate readings by different persons are invariably taken as a check. The liquor and tar are then run off for sale. It is important that the tanks should be carefully examined after a sale of liquor, to see that they have run completely dry. The recesses in the cast-iron plates forming the bottom of the tank are filled with cement, giving a fall towards the drain service, the cement also being scored with channels. The delivery-pipe is carefully plugged-up, to obviate any risk of valves leaking. To prevent loss of ammoniacal liquor, it is very important to keep liquor delivery pipes and valves perfectly tight, and to circulate the liquor without exposing it unnecessarily.

Tar is estimated on the usual selling basis—that is, with a liquor content of 3 to 4 per cent.

To the actual production of liquor, recorded in gallons of 10 oz. strength, is added the ammonia passing the final washer, as determined by continuous quantitative tests. This loss in washing does not amount on an average to more than 2 grains per 100 cubic feet, or less than 0·5 per cent. of the total.

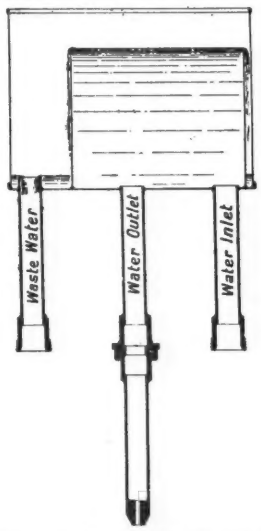


Fig. 4.—Constant Water-Flow Device.

The amount of virgin liquor is determined with the aid of a special device for preserving a constant flow of water to the ammonia washer. The principle of this device is the delivery of water at a constant head to a calibrated jet. It consists of a copper vessel fitted with a smaller inner drum. The water supply is fed to the inner drum at such a rate as to feed the jet, which is also connected to the inner drum, and to deliver a surplus quantity of water to waste as an overflow from this drum. It is thus ensured that the inner drum is constantly full, and a constant head to the jet delivery maintained.

The device is fitted with a detachable jet, which can be replaced by others giving a range of rate of flow varying from 10 to 70

Effect of Alteration in Weight and Duration of Charge and Retort Temperature.

[Coals A, B, and C, weight and duration; coal D, weight and temperature.]

Coal.	Test.	GAS AND BYE-PRODUCTS.											
		Charge.	Duration.	Weight Carbonized per Retort per 24 Hours.	Retort Temp.	Gas.					Coke (Dry).		Liquor. Gallons.	Tar. Gallons.
						Make.	I. P.	I. P. Multiple.	C. V.	C. V. Multiple.	Total.	Fuel.		
		Cwt.	H. M.	Cwt.	Deg. F.	Cub. Ft.					Per Cent.	Per Cent.		
A.	I.	6·49	6 0	26·0	1880	11,940	15·34	183,200	537	6410	63·9	17·9	38·8	11·7
	II.	8·76	8 0	26·3	2005	11,500	15·80	181,700	520	5980	64·3	16·7	36·5	11·9
	III.	13·41	12 0	26·8	1990	11,210	15·27	171,200	528	5920	63·9	19·4	34·5	12·3
B.	IV.	8·10	8 0	24·3	1875	11,930	15·61	186,200	543	6480	64·7	18·2	34·1	10·2
	V.	12·21	12 0	24·4	2065	11,780	15·16	178,600	507	5970	64·1	15·0	33·0	12·0
C.	VI.	6·41	6 0	25·6	2000	11,830	16 68	197,300	548	6480	69·5	16·9	32·9	12·6
	VII.	9·72	9 0	25·9	2045	11,670	16·62	194,000	541	6310	67·8	18·5	32·0	12·0
D.	VIII.	4·54	6 0	18·2	1640	9,390	17·00	159,600	577	5420	73·0	15·5	31·3	14·8
	IX.	5·52	6 0	22·1	1885	12,120	16·92	205,100	541	6560	68·1	12·6	36·2	12·3
	X.	6·56	6 0	26·2	2070	12,380	16·99	210,300	544	6730	68·3	15·5	31·4	12·0

Gas Analysis in above Tests.

Test.	Crude Gas. H_2S. Per Cent.	Gas Purified with Oxide.								
		Sulphur. Grains per 100 c. ft.	CO_2. Per Cent.	C_nH_m. Per Cent.	O. Per Cent.	CO. Per Cent.	H. Per Cent.	CH_4. Per Cent.	N. Per Cent.	Specific Gravity.
I. . . .	2·07	48·8	2·16	3·78	0·79	8·28	46·7	30·0	8·3	·437
II. . . .	1·98	46·5	1·72	3·50	0·80	9·15	48·5	30·0	6·3	·417
III. . . .	1·83	47·9	1·89	3·44	0·61	9·39	48·0	27·5	9·1	·435
IV. . . .	1·81	36·8	2·37	3·30	0·40	8·35	..	..	..	..
V. . . .	1·84	29·8	2·25	3·78	0·53	9·85	49·2	26·8	7·6	..
VI. . . .	1·85	68·1	2·00	4·00	0·52	7·10	43·3	34·1	9·0	·417
VII. . . .	1·78	57·6	1·80	3·60	0·45	8·00	48·5	31·3	6·4	·416
VIII. . .	1·77	26·5	2·05	3·53	0·63	7·53	44·8	34·1	7·4	·424
IX. . . .	1·70	28·1	1·70	3·72	0·67	7·10	38·2	42·7	5·9	·424
X. . . .	1·57	28·4	1·74	3·68	0·69	7·71	31·6	49·5	5·1	..

gallons per hour. So long as water is always running to waste from the overflow, the rate with a given jet remains constant to within less than ½ per cent. The definite variability of the flow enables one to regulate the strength of the liquor as required.

In calculating the virgin liquor made during a test, the volume of water required to fill the various apparatus—retort-house tank, hydraulic mains, tar-tower, Livesey washer, and Holmes washer—is added to the product of the rate of flow of wash water and the number of hours of test, and the sum is subtracted from the total volume of liquor made. The difference is virgin liquor.

Valves.—It may not be out of place here to point out the urgent necessity of having the most reliable types of valves for a test works. We have experienced considerable trouble with various kinds of valves for both liquor and gas; and for a time the tests were rendered untrustworthy on this account. The plugging of the tar and liquor delivery pipes of the sales tanks has already been referred to. This practice was resorted to following on the discovery of faulty cocks and services. A rack-and-pinion valve had been fixed as a bye-pass to the station-meter. This valve when tested for tightness on Sunday was often found to show a slight leakage. It was eventually removed, and a hydraulic lute substituted. This consists simply of a cast-iron box fitted with inlet and outlet, and having a midfeather extending to within 4 inches of the bottom. The seal is made with tar to obviate evaporation, and pump connections are fixed in case it should be desired to bye-pass the meter. The purifier valves are of the screw-down wooden disc pattern. These have also given some trouble; the wooden discs being very liable to crack badly and so bye-pass gas. This was considerably improved by substituting poplar instead of oak discs, which latter were formerly fitted. But in the case of the more important valves—such as the bye-pass to the catch-box—we have found an excellent joint may be made by facing the wooden disc with a sheet of soft lead.

Dry Hydraulic Main.—Up to date, we have not been able to carry out a complete test with the dry main It will be necessary to modify our method of working in order to obtain satisfactory results. It will, no doubt, be interesting to the members, however, if we briefly relate our experiences during the trials. The hydraulic and tar mains were run off quite dry; the liquor supply was shut off; and the syphons feeding the hydraulic mains and that from the tar tower were closed. The sludge-cocks to the hydraulic mains were left open, so that any liquor or tar settling out immediately drained away to the tar-tower, which was run off every few hours. Very soon it was observed that the automatic U syphon in the casting under the valve of the retort-house governor was delivering unusually thick tar. The tar from the tar-tower also became extremely sluggish. We decided, however, to work on in the same way as long as possible, to see the result. Eventually, after minor troubles with sludge-cocks, and tar main blockages which were successfully negotiated, a serious blockage in the air-condensers arose. Attempts to move this with steam were futile; and at length the stoppage necessitated bye-passing the condensers. It was then discovered that the tar and liquor overflow on the second section was completely blocked with naphthalene and soft pitch—the other overflows being also more or less made-up. After having worked for a fortnight with the dry main, we changed to ordinary conditions; but more than a week elapsed before tar and naphthalene troubles ceased. The bye-pass governor to the exhausters became clogged, the Livesey washer and rotary scrubber blocked, and it was necessary to steam the wells and sales tanks before the tar could be made to flow with sufficient freedom.

Heavy Charges; Effect of Alteration in Weight and Duration of Charge.—Further experiments were carried through with the object of settling, to our own satisfaction at any rate, the vexed question as to whether heavy charges improved the gas production or not. Three series of tests were conducted, in each of which retort temperature and rate of carbonization (approximately 1 cwt. of coal per retort per hour) were as nearly as practicable the same. The complete results for coals A, B, and C are tabulated above. The tests confirm the conclusions already arrived at—that filling or nearly filling the horizontal retort effects no improvement in gas production. There is, indeed, a slight, but distinct, depreciation in the value of the gas. The Derby results are thus corroborated.

Rate of Carbonization.—The test plant retorts are of such a size as to thoroughly carbonize 6 cwt. of coal in six hours at temperatures of 1900° Fahr and upwards. Some coals give better results when carbonized at the rate of 6½ cwt. in six hours; others do better at the lower rate. Much depends on the nature of the coal in question, and the time it takes to distil.

Effect of Simultaneous Alteration in Weight of Charge and Retort Temperature.—In the series ot tests performed with coal D, the weight of charge was altered to suit the retort temperature as well as could be judged at the time. In each case, the coke had the appearance of being satisfactorily "burnt off."

It is evident, on looking through the figures, that high temperature is essential to proper carbonization. There are several items of interest in the tables which, however, may be allowed to speak for themselves.

In conclusion the authors express the hope that this paper—disjointed though it is—may prove useful to members; and, as experimenting is one of the functions of the Birmingham coal-test plant, they will welcome suggestions for future trials.

Discussion.

The PRESIDENT (Mr. R. S. Ramsden, Burton-on-Trent) remarked that, as an Association, they were extremely obliged to Dr. Davidson and Mr. Pearson for the trouble they had gone to in the preparation of the paper, and for giving the results obtained with the test plant. The arrangements for shutting-down the plant on Sundays seemed to be similar to those generally in force. At Burton, however, since they had gone in for the twelve-hour charges of 14½ cwt. per charge, they had found it necessary to

adopt a rather different plan. They put the last charge in at 4 o'clock on Sunday morning; and they could not stop the exhauster until about 3.30 in the afternoon. With long-hour charges and stoking machinery, he thought the very slight difference that could be made in the number of men required on the ground was not a sufficient set-off to the increased number of beds that it was requisite to keep at work and the wear and tear on the retorts generally. The experiments of the authors with regard to the deterioration of coal on stacking formed a strong argument in favour of letting coal, after they had stacked it, stop down, and not using it up frequently. If they adopted the latter course, the expenses of handling would be more than the amount of the saving in deterioration. Experience at Burton in the matter of retort-house governors bore out that at the coal-test plant—namely, that the governor with the counterbalance gave them a very much steadier line than the one with the air-float. At Burton, they had been getting with the former lines quite as good as those shown on Chart VI. in the paper. He had been trying to find out, but had not quite managed to do so, the relation between the pressure in the retort, or the ascension pipe of any individual retort, and the pressure in the collecting main at the inlet of the retort-house governor. If Dr. Davidson had had any experience of this, perhaps he would tell them of it. According to the illustration of the anti-dip valve in the paper, it appeared to him that when the cone was drawn up, the outlet of the dip would be closed entirely; and, this being so, it did not seem to be quite such a good anti-dip arrangement as had been adopted at Burton, on the recommendation of Mr. Bell after his experience with it at Derby. It was the pattern originally invented by Mr. Simmonds, of Bury. The ascension-pipe and bridge-pipe might be of any type; and the anti-dip was made by cutting a slot so as to make a square or rectangular opening about 5 in. by 4 in. at the bottom of the dip-pipe. On either side of the slot there were grooves; and working in these grooves there was a plate. This plate was lifted up and down in the same way as the cone; but there was liquor in the hydraulic main. Working twelve-hour charges, about an hour-and-a-quarter before the retort was drawn the slide of the anti-dip valve was dropped, and for the last hour-and-a-quarter they worked with the ordinary sealed dip-pipe. The experience at the test plant working with a tar-seal bore out what his (Mr. Ramsden's) father used to tell him he found—that the tar-seal kept down naphthalene. Speaking from memory, he believed this was what Mr. Ellery, of Bath, said in his Presidential Address before the Southern District Association.

Mr. R. A. S. Browning (Saltley) asked what was the object of the authors in bye-passing the different apparatus in shutting-down on Sunday. He would also like to know what was their opinion with regard to the most economical method of producing gas—whether to aim for an illuminating power of (say) 15½ to 16 candles and a moderate make per ton, or to secure a high make of a lower illuminating power and use an enricher. It had always been his own experience that it was easier to get the multiple on the illuminating power than on the make per ton. He thought this was borne out in the two tests on the same coal given in the paper. A make per ton of 11,220 cubic feet of gas of 16·58-candle power would give a multiple of 186; while a make of 13,600 cubic feet of 13·53-candle gas would only give a multiple of 184. The experiments with dry mains were certainly very disastrous. At one time he was engaged for a couple of years at a place where they worked with dry mains throughout; and they had no such trouble with thick tar. They worked with a retort-house governor set to give 1-10th pressure in the ascension-pipes.

Mr. F. J. Ward (Knowle) said the paper appealed to him as an old retort-house foreman, and as one who was in charge of works now which were somewhat of a test works, though they were not able to devote such an amount of time to the manufacturing operations as was done at the Birmingham test plant. He failed to see why all the elaborate precautions enumerated should be taken in shutting-down and starting-up the plant. In his own works, they shut-down and started-up sometimes two or three times a day (laughter); and if they went through all these operations every time, he did not know when they would make gas. He certainly did not see the necessity for it, unless it was that they had to make rules because they could not quite trust the workmen. If they had a washer, they could let things run their normal course. He never shut a valve; the washer saw to this. The gas could not get back if they had (say) a Livesey washer. He understood that it was necessary to notice particularly the position of the primary and secondary air slides and the dampers. This was a thing a man could, when he was used to it, regulate to a nicety with his fingers. As to the weights of coal sent out by the colliery people, at the present time they were much stricter than used to be the case, because the railway companies gave notice that they would charge for every hundredweight that went over their lines. Consequently, the colliery people were more careful. At one time, they would get 5 cwt. or so overplus on each truck; but now they did not have 1 cwt. Taking the average, it came out about right. He agreed that ordinary coal did not deteriorate much by stacking, and should say it was best to put coal into stock and keep it there. They could depreciate it in their accounts if they wished to; but they should keep on working with fresh coal, and retain the stacked coal as a reserve in case of strikes, and so on. He had found it best to stack a hard coal, such as a Welsh coal. Of course, it was their aim to produce gas of uniform quality; but in small works this was difficult. Consequently, it was very necessary for the inlet and outlet of the holders to be far removed from each other, so that the gas should be thoroughly mixed. If this was done, one need not trouble particularly about uniformity as the gas was produced, because it would go out into the district uniform. So far he had seen no reason to recommend the use of a retort-house governor at his works, because he could keep his gauge practically steady all the time without it. He had designed an anti-dip for his works very much like the one shown in the paper, with a slight exception. His was not completely blocked. The dip-pipe was cut in two on its circumference; and to unseal the pipe the bottom portion was lowered. On raising it, the pipe was sealed. He did not work with a dry main.

Dr. Davidson pointed out that this arrangement would not be suitable for use when working with a dry main.

Mr. Ward (continuing) said, with regard to working with the tar-seal, apparently the authors had not made any provision for the difference in specific gravity between liquor and tar. They had given the same pull in each case—4-10ths—and this might account for the difference in the make. Lastly, as to the weight of charge. It seemed the authors had come to the conclusion that light charges were the best. Personally, his opinion was that with certain coals a moderate charge was the best; and with some sorts a heavy charge was preferable—a heavy charge with a moderate heat. But he had also come to another conclusion. He had many times heard it said that gas should be taken away from the retort as quickly as possible—presumably because of superheating. This was so when the passage for the gas was very near the crown of the retort. But there were different kinds of charges with which his experience had proved to him that it was possible to obtain extraordinary results. Probably some of those present knew that at the Widnes Gas-Works Mr. Isaac Carr used to carry out superheating—the gas he made in (say) the outside retorts would pass again through the middle retort, and decomposition took place. The idea was discarded; but he did not know why. His own opinion was that superheating to a certain extent was good. He had made very nearly 14,000 cubic feet of gas per ton; and the lines he was working on now were charging much heavier at the back, and at the same time seeing that the back-end of the retort was much hotter than the front. They were single-ended retorts.

Mr. C. Carrington Barber (Adderley Street), referring to the question of multiple, said he did not think they should place too much emphasis on this. They should get as big a make as possible of a saleable quality. He agreed with the authors that the recording calorimeter was much better than the jet photometer. With it one was much more readily able to detect any irregularity in the working of the retort-house. To his mind, retort-house governors were rather overdone. He had one, and had worked both with and without it; and there had been practically no difference in the results. The authors put the gain by their use at 3 per cent.; but he had not found any increase. Then as to increasing the pull, at Adderley Street he started with 4-10ths pull on the exhauster during the draw, and increased it 8-10ths or 9-10ths when all the retorts were closed, which enabled him to attain an improved result of 2 to 3 per cent. over a continuous pull. He thought it would have been better to repeat this test at the coal test plant two or three times. He fancied a difference of about 1 per cent. might be accounted for by the difference in the coal during this time.

Dr. Davidson remarked that he and Mr. Pearson would divide the work of replying to the discussion. As to stacking of coal, he cordially agreed with the President that the coal should be handled as little as possible, from the point of view of expense. He also agreed with Mr. Ward when he said that some coals—particularly Welsh sorts—were practically not affected by weather; and these were the coals that should be selected if possible for stacking. In his opinion, they ought to be left down for several years, and so save the expense of picking up. With regard to the relation between the pressure in the retort and the pressure at the inlet of the retort-house governor, there was no doubt a difference owing to the pressure in the retort being a dynamic pressure—it had to break a seal—and the pressure at the inlet of the retort-house governor not being to the same extent a dynamic pressure; but the difference they found was very slight. If they were working with a level gauge with seal, and set the retort-house governor to give a level gauge in the retorts—that was, set it with a 4-10ths pull, the seal being also 4-10ths—and they took the pressures in the retorts, for the first two hours they might have up to 2-10ths pressure, and the last two hours possibly as much as 2-10ths vacuum. But the average would be level gauge. They could not work a single small retort in any way that he knew of so as to give level gauge all the time. He had seen it done on a chamber oven. This served to answer another question with regard to uniformity of gas. It was asserted by some gas engineers—he had met one, at any rate, who said so—that the long duration of charge usual with chamber ovens was not so detrimental to the quality of the gas, or to the illuminating power given by an incandescent mantle, as people would be apt to expect, because if they regulated the pressure carefully in the chamber—increasing it towards the end of the charge—the result would be that they would not get the admission of much nitrogen. The specific gravity of the gas would diminish, and the consumption in the incandescent burner would increase. Thus the total effect in illuminating power with the burner would be practically constant. This was a point they could not really observe; they had not the

mechanical means in the retorts. It could be done in the chamber oven by using a displacer in the hydraulic main, which was separate for each chamber—using the displacer from hour to hour, and increasing the dip as the gas got poorer and poorer, that was to say, putting on a little extra pressure to prevent the admission of any furnace gases. The anti-dip shown in the paper was designed by him so far as regarded its essential feature, which was the cone. The rest of it was subsidiary; and he certainly was surprised that both the President and Mr. Ward should have missed the vital point about the dip—that it permitted one to work without liquor or tar seal throughout. One could work with an absolutely dry main, and still close the dip pipes during the period of charging. This was a distinct advantage, which could not be secured with the Simmonds, Cort, or Ward type of anti-dip. A possible future advantage was that it might enable them to adopt means of fractionating the tar. This was only a possibility; but naturally they went in for experimenting at the test plant, and this type of anti-dip allowed them to do so. They took the tar away from the main nearly as hot as possible, without any liquor or water in it, and fractionated it. They proposed to do it, at least. As to working for a multiple, this was a matter they must balance out for their own works. They had to consider capital costs, labour, and the cost of gas, before deciding which was the better course to adopt—whether to work strictly for a multiple, or aim for a large amount of gas and enrich it. He thought in most cases it was desirable to increase the make and enrich—particularly when commercial benzol was cheap. Mr. Browning was no doubt quite right about dry mains. At the test plant, however, it was their first attempt; and they let things go on without trying very hard to prevent trouble. They wanted to see really what trouble would arise from working with a dry main. Mr. Ward referred to working with 4-10ths tar-seal and 4-10ths liquor-seal. The possible difference in the two cases was very slight—quite negligible, in fact. What Mr. Ward had said on the subject of charges was common knowledge. It was necessary, of course, to crack up the tar to a certain extent; the difficulty was to decide upon the extent. If they simply got the gas away as quickly as possible without cracking up the tar or heavy hydrocarbons that were given off, they would not get the same production as if they did crack them up. This had been proved. He quite agreed with Mr. Barber when he said that they should have repeated the tests with the difference in pull; and perhaps it was unwise to give the results as they had done. It was very difficult to decide the point when coal, and weather, and other factors interfered with the results; but if there had been a great difference, they would have seen it. There was a marked difference between Mr. Barber's retorts and those at the test plant. With Mr. Barber's permission, they tried the experiment of taking samples of gas when there was a difference of 4-10ths in pressure—one with 2-10ths pressure, and the other with 2-10ths vacuum in the retorts; and the difference in nitrogen was less than 2 per cent. With the test-plant retorts, which were not nearly so tight, the difference in nitrogen was three or four times as much. Now, this was very important. They could not draw in nitrogen without spoiling the multiple. Mr. Barber could get his gas away very quickly, and possibly gained a distinct advantage by so doing.

Mr. PEARSON agreed with what Mr. Ramsden had said as to shutting-down. The time of shutting-down between 3.30 and 10 o'clock was very small; and working with machines and long-hour charges, there were probably few men on the ground. It was a question whether shutting-down on Sunday helped them much as regarded time off from the works; and taking everything into consideration, it was doubtful whether it was worth while. They had been asked why they bye-passed the apparatus when shutting-down. There were two very good reasons, and both were equally important. The first was that if they shut every valve to apparatus on Sunday it ensured that the valve was moved once a week; and therefore they were certain it was always in good order. If a valve was left over a period of a week or so, it often got stuck, and when wanted urgently was out of order. Then when apparatus was left over the Sunday, it was possible, though perhaps not probable, that there might be something the matter with it; and if they started-up with this apparatus bye-passed, they were certain of a clear passage for the gas. The system at the test plant was to put each apparatus on separately, one after the other; and they ascertained by watching the gauge that each one was in proper working order. Mr. Ward said he found his holder pressure was insufficient to pass gas through his Livesey washer. He did not quite follow what he meant; but at Nechells they worked into holders with 12 inches pressure, and the seal on the washer was ¾ inch, which he would not like to have to trust to to keep the gas back in the event of anything going wrong. It was very necessary to have the valves on the retort-house side closed, because the exhausters, when stopped, would leak a little. As to regulation of the slides, they found it preferable to have chalk marks in the position in which they happened to be working, for the good reason that they were always changing their coals; and thus it was necessary to alter the slides to accommodate the particular coke they happened to be burning. At the test plant, the coals were continually varying, and the slides continually being altered. The alteration perhaps depended more upon the amount of clinker formed than anything else. It was essential, in view of these alterations, that the slides should be put back on Sunday night to the position in which they were found on the Sunday morning. The advantage of a retort-house governor depended primarily upon the exhausters used. If the exhausters and the governor on them worked smoothly and well, there was probably no reason at all for having a retort-house governor; but in the coal-test plant, as had been clearly set forth in the paper, the exhausters worked very irregularly. Therefore it was essential that they should have a retort-house governor. When they spoke of the gain resulting, they referred, of course, to the coal-testing plant. With regard to Mr. Barber's remarks about putting on extra pull, it had always to be carefully considered that coal-testing plant results must to a great extent be confined to that plant. In the case of Adderley Street, there might easily be some cause for the difference. It was a case of getting the gas away quickly from the retorts. It might be that at Adderley Street when they worked at level gauge the gas was not taken away sufficiently fast to get the best results from the make.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Gas Charges and Meter-Rents.

SIR,—In your "Editorial Notes" on this subject in this week's issue of the "JOURNAL," I observe that you compare the charges made by the Gaslight and Coke Company and my Company under these heads for the year 1909, and remark that the charges for gas alone were, in the case of the Gaslight and Coke Company, 32·01d., and in the case of my Company 29·21d., per 1000 cubic feet; while the charges for meter-rents were 0·61d. and 2·39d. respectively.

I would, however, point out that the Commercial Company's figure of 2·39d. includes coin-meter and fittings rental, while the Gaslight and Coke Company's figure of 0·61d. would appear to be the ordinary meter rental only.

STANLEY H. JONES, Engineer,
Commercial Gas Company.

Stepney, April 28, 1911.

Estimating Sulphur in Coal Gas.

SIR,—In your issue of April 25, I noticed the reprint from the "Journal of the Society of Chemical Industry" of the paper by Mr. H. Blair, on "A Rapid Method of Estimating Sulphur in Coal Gas and Sulphate of Ammonia." The method described applied to the determination in sulphate of ammonia gives practically theoretical results, but when used to ascertain the sulphur content of the liquid from the Gas Referees' apparatus, it gives rather higher results than are indicated by precipitation as barium sulphate.

Some time ago, when applying a somewhat similar method—afterwards described by Mr. Lee, of Sheffield, to the Yorkshire Junior Gas Association, on March 20, 1909, who had applied it—to the analysis of ammonium sulphate, I came across a similar discrepancy between the volumetric and gravimetric methods when applied to the analysis of the liquid from the Referees' apparatus.

The method consisted of boiling the liquid containing the ammonium sulphate with excess of sodium hydrate for a few minutes, and then calculating the loss of alkalinity, due to the formation of sodium sulphate, to sulphur. It was found that in every case the figures were higher than the usual gravimetric determination by some 1·5 to 3 grains—a result ultimately traced to the presence of ammonium nitrite. Perusal of the literature of the subject disclosed the fact that flame-combustion in air gives rise to small quantities of nitrous acid—amply explaining its presence in the liquid from the Referees' test. Probably the nitrous acid is responsible for the high results in the method that is described by Mr. Blair.

Very good results may be obtained by adopting the following procedure with the alkali method. The liquid, from 10 cubic feet of gas, condensed in the Referees' apparatus, is made up to 500 c.c. Then 123·4 c.c. (a quantity easily remembered) is measured out by a specially graduated pipette, and boiled for a few minutes with 10 c.c. normal sodium hydrate (or other convenient quantity or strength) to expel the ammonia. While still hot, a like quantity—10 c.c.—of normal sulphuric acid is added, and the boiling continued as before—this time to expel nitrous acid. The liquid is then cooled and titrated with tenth-normal sodium hydrate—methyl orange as the indicator. The grains of sulphur per 100 cubic feet are then indicated on the burette without calculation—1 c.c. equals 1 grain. The results may still run high if the nitrous acid is not wholly driven off, or if appreciable quantities of it are oxidized to nitric acid.

A. EDWARDS.

Laboratory, Corporation Gas Department,
Leeds, April 26, 1911.

The Arrangement and Use of Tar-Towers.

SIR,—Your contributor, Mr. G. M. Gill, under the heading "The Arrangement of Tar-Towers" in your issue of April 25, discusses the utility of the equilibrium pipe usually employed to maintain equal conditions of "pull" in both tower and main, and so keep the liquor at the same level in each vessel. He seems to advance the opinion that the connection is a more mischievous than necessary adjunct to the tar-tower, and can well be dispensed with. There is nothing to quarrel with in this view, although his objections against the use of the pipe are somewhat weak ones. But one would like the condition of affairs—when atmospheric pressure is allowed free access to the tower—somewhat more fully set forth. Admittedly, the levels in the two vessels—the hydraulic main and the tower—will be different; but Mr. Gill dismisses this with the words "but the difference is known, and is allowed for." It is just on this point that a little more information is desirable; and in order to comprehend the situation, we had better state a case.

We start with retorts empty, and wish to seal the dips, and (say) set

the overflow from the tower to give ½-inch seal. As soon as gas begins to flow, we start the exhauster, and maintain a certain vacuum in the hydraulic main. If the equilibrium pipe is working in such a case, we should have to put ½-inch vacuum on the hydraulic main if we wished to run with an average "level gauge" in the retort. If we desired ¼-inch pressure on the retort, we should pull ¾ inch and so on.

Consider now what would happen in the absence of an equilibrium pipe. The tower is open to the atmosphere, and forms with the hydraulic main one limb of a U-tube, in which the level of liquid is fixed—*i.e.*, at the overflow; and the dip-pipes are ½ inch below this level. We now put ½-inch vacuum on the hydraulic main. The level of liquor in the main must immediately begin to rise; and if we are pumping sufficient liquor to keep the tower overflow working, it will ultimately come to rest ½ inch above the level of the tower overflow, since the latter is still subject to atmospheric pressure and is in a fixed position. In other words, we have now 1-inch seal—the ½ inch we started with *plus* the ½ inch due to the pull. We have also ½ inch average pressure on the retort. In the same way, if we put 1-inch vacuum on the hydraulic main, we should raise the liquor level 1 inch and have then 1½ inches seal and still ½-inch pressure on the retort.

In fact, the combination of tower and main without an equilibrium pipe is acting as a governor of sorts—consistently maintaining on the retorts a pressure exactly equivalent to the amount of seal originally set by the tower overflow. If we desire to work with a "level gauge" in the retorts, the tower overflow must be set at the same level as the dip-pipes; and when starting up and letting down, the latter would be left with no seal at all. Whatever vacuum we subsequently put upon the hydraulic main would raise a "seal;" but the condition of affairs in the retort would remain at level gauge—presuming, of course, that, throughout these variations, sufficient liquor is admitted to the main to keep the tower overflow constantly working. In fact, without the equilibrium pipe, the seal on the dip-pipe is—well, anything you like to pull it to. And the condition in the retort depends upon the difference in level between the tower overflow and the dip-pipe, and cannot be altered until the former is reset.

My only reason for writing is to ascertain to what extent the governing action indicated above is designedly used, and how it behaves in practice. There are in existence types of mains other than those fitted with towers, in which side overflows are arranged open to the atmosphere for ready inspection; and these will act precisely as the tar-towers do without the equilibrium pipe. One wonders if those in charge fully realize the extent of the "seal."

A. EDWARDS.

The Laboratory, Corporation Gas Department,
Leeds, April 28, 1911.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Chesterfield Gas and Water Board Bill, Felixstowe and Walton Water Bill, Gaslight and Coke Company Bill, Ipswich Corporation Bill, Northampton Corporation Bill, Paignton Urban District Council Bill.

Bills read the third time and passed: Luton Gas Bill, Oystermouth Urban District Council Bill, Sidmouth Gas and Electricity Bill, Warrington Corporation Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Luton Gas Bill, Oystermouth Urban District Council Bill, Sidmouth Gas and Electricity Bill.

Lords Bills read a second time and committed: Chesham and District Gas Bill, Ely Rural District Water Bill, Enfield Gas Bill.

Lords Bill reported: Chesham and District Gas Bill.

Bills read the third time and passed: Chesterfield Gas and Water Board Bill, Northampton Corporation Bill, Paignton Urban District Council Bill.

The Local Government Provisional Orders (Gas) Bill, to confirm Provisional Orders relating to Cudworth and Liverpool, has been presented, read the first time, and referred to the Examiners.

A petition against the Enfield Gas Bill [Lords] has been presented by the Middlesex County Council.

CHESHAM GAS BILL.

The Unopposed Bills Committee of the House of Commons presided over by Mr. J. H. WHITLEY had before them last Thursday the Chesham and District Gas Bill.

Mr. JOHNSTON, who represented the promoters, explained that the Bill sought to incorporate the Chesham and District Gas Company, who were a limited Company formed under a Deed of Settlement in 1847, and subsequently registered under the Companies Acts. They supplied gas in the town of Chesham and neighbourhood. The present capital of the Company was £12,000, made up of £10,000 ordinary and £2000 preference. The proposal was to convert the existing capital on an 8 per cent. basis—consolidating the dividend to 5 per cent. all through, and bringing the capital of the new Company to £16,000 at 5 per cent. The additional capital they were seeking was £20,000. They originally asked for more than this; and in the other House they were strongly opposed by the Local Authority. Eventually they came to an agreement; the additional capital, among other things, being cut down. The Local Authority succeeded in getting amendments, not only as to capital, but in regard to price. The capital asked for was reasonable, allowing for an expenditure over a period of 15 years. Based on the extension of the last five years, and the same rate of increase in 15 years, the sale would be about 66 million cubic feet; requiring, at the £750 minimum, nearly £32,000 of additional capital. The amount asked for, including borrowing powers, was under £30,000. They were really asking for less, including the borrowing powers, than their calculations showed might probably be necessary in the course of the next 15 years. Recent dividends had been at the rate of 8 per cent. Previous to this, they were as much as 10 per cent. The dividend was only 5 per cent. in 1906; the principal reason for this being the introduction of electric lighting. While the Company had not been paying as high a dividend as they might have done, they had been continuously reducing the price of gas. The last 10 per cent. dividend was in 1901.

Mr. H. STAVELEY-HILL (a Member of the Committee): Your ordinary consumers have increased very slightly; and your prices seem to have remained the same both for slot and ordinary consumers for some seven or eight years?

Mr. JOHNSTON agreed, and said he thought it had been due principally to the electric light. The present selling price was 3s. 9d. The Company did not ask any higher price than the actual selling price. The electric light was in the hands of a Company.

The CHAIRMAN: There is no possibility of your ever entering into an alliance with, or buying up, the electric lighting concern?

Mr. JOHNSTON: Not judging from past relations. The number of years after which the Local Authority may purchase is a long term.

The CHAIRMAN said the Committee were satisfied with the financial clauses.

With regard to the extra charge of 1s. for which the Company asked authority in relation to the outside area,

Mr. JOHNSTON, in reply to the CHAIRMAN, said 6d. would not be enough. The new area was a very wide one. The position was that they wished, more or less by arrangement with adjacent gas companies, to take the limits of their supply up to a certain point beyond the existing limits. The radius of supply would then be three miles from Chesham Town Hall; and it was contemplated that the extra charge should never be more than 1s. The Company did not want to charge more than was necessary. The proposal of the promoters followed the Bishop's Stortford Act of last session.

Mr. MOON (Speaker's Counsel): But it must all depend on the area. A shilling is a good deal.

Mr. A. L. PERKIN: It is only a permissive power.

Mr. MOON: If you don't want it, why should you charge it?

Mr. PERKIN: In giving a supply to a village it might be necessary, although in supplying centres of population we might very well give it at an extra 6d. This is the intention of the Bill; and the clause is so worded.

The Committee consented to the provision.

Minor alterations were then made in various clauses, bringing them into harmony with the Model Clauses; and the Bill was ordered to be reported to the House.

THAMES CONSERVANCY AND WATER BOARD BILLS.

The Joint Committee of both Houses of Parliament, presided over by the EARL OF KINTORE, to whom the Bills of the Metropolitan Water Board and the Thames Conservancy have been referred, re-assembled last Wednesday; and, in accordance with the intention announced by the Chairman at the previous sitting (*ante*, p. 119), they entered on the consideration of the Thames Conservancy Bill.

Mr. VESEY KNOX, K.C., who (with Mr. CLODE) appeared for the promoters, said the principal objects of the Bill were to provide for an increased payment by the Water Board to the Conservators of the Thames for the upkeep of the river, and to substitute for a number of confused enactments regulating the abstraction of water from the Thames a short and comparatively simple regulation which would be available practically for all time. This scheme was not directly connected with the proposals embodied in the Water Board's Bill, but it was necessary that the conditions of abstraction should be determined by Parliament, because until this was done engineers could not tell how much storage was required. The opposition of the Port of London Authority and the Surrey County Council was confined mainly to one point. They objected to the 140 million gallons limit the promoters placed as the minimum daily flow at Teddington, and suggested that the quantity should be greater. It was not until 1896 that any statutory provision was made for the maintenance of a minimum flow of water in the river. In 1899, Lord Llandaff's Commission suggested that it should be 200 million gallons daily, subject to a reduction in times of drought. In the opinion of the Engineer to the Conservancy Board, this conditional arrangement would be unsafe and impracticable. A fixed scale of contributions by the Water Board to the Conservators had been agreed upon. From 1912 to 1916 the annual payment would be £40,000; and from 1917 to 1941, and thenceforward from year to year as long as no greater quantity of water was taken from the river than a daily average of 300 million gallons, the total payment would be £45,000 per annum.

Lord *Desborough*, the Chairman of the Conservancy Board, was the first witness. He said the Board were advised by their Engineer that certain works which would cost £92,000 were needed; but they had not the money to carry out extensive undertakings.

On the re-assembling of the Committee on Thursday,

Mr. *G. J. Griffiths*, the Engineer to the Conservancy Board, said the scheme agreed upon with the Metropolitan Water Board would allow ultimately the abstraction of 300 million gallons of water daily. The Water Board would give up their unrestricted right to abstract water—a right which was harmful when it was exercised in dry seasons; but the minimum flow provided by the Bill (of 285 million gallons daily at Penton Hook Weir) would not entail any substantially greater reservoir

capacity. What the Conservancy Board wanted was an absolute fixed minimum not to be varied by the Local Government Board. In witness's opinion, the proposed diminution of the flow would not have any damaging effect in the upper reaches of the river. The scheme put forward by the Conservancy was, he thought, a good one for regulating the water in the river.

Mr. *Walter Hunter*, M.Inst.C.E., said he had given very careful consideration to this question, and he entirely agreed with all that the last witness had stated.

This was the case for the promoters.

Lord ROBERT CECIL then addressed the Committee for the Surrey County Council, and Mr. RALPH BERRY on behalf of the South-West Suburban Water Company, who opposed the Bill.

Mr. *F. Palmer*, M.Inst.C.E., the Chief Engineer to the Port of London Authority, maintained that the proposals in the Bill, by reducing the flow of water below Richmond, would interfere with the navigation of the river; but he indicated how his objection could be met.

There being no further evidence,

Mr. BALFOUR BROWNE, K.C., addressed the Committee on behalf of the Water Board. He said the Board had purchased the absolute right to take up to 300 million gallons a day from the Thames, whatever might be its condition. They were willing to give up this right on the terms that they were not to be put to greater expense in the provision of storage than they would be if they exercised their right to abstract 130 million gallons a day. The bargain which had been entered into with the Thames Conservancy, that the minimum flow at Teddington Weir should be 140 million gallons, was not necessarily to remain for all time. If in future a company obtained parliamentary powers to take a large quantity of water from the river, he might have to go to the Conservancy and make an entirely different bargain.

Mr. VESEY KNOX, in reply, said that the rapid construction of proper storage was the only safeguard for the river. The Conservancy felt it was their duty to protect the river so that the Water Board might not, by abstracting water, interfere with the minimum flow of 140 million gallons a day. If an emergency arose, the water would have to be taken for the needs of the population; but in such a case the Conservancy would prefer that the law should be flatly broken than that, as suggested by the Water Board, the Local Government Board should have the power to say there was to be no minimum flow at all.

The CHAIRMAN intimated that the Committee would give their decision on the Conservancy Bill when they had finished the proceedings on the Water Board Bill.

The inquiry on this Bill was then resumed.

Mr. *W. B. Bryan*, M.Inst.C.E., the Chief Engineer to the Water Board, explained the modifications in the scheme which had been made necessary by the Committee's decision that reservoirs Nos. 1 and 2 should be struck out of the Bill. These included the elimination of several conduits and cuts, the diversion of certain footpaths, and the taking of certain common lands.

Evidence was then given in support of the petition of the London and South-Western Railway Company, and the Committee adjourned.

APPLICATIONS FOR LETTERS PATENT.

9525.—MACKENZIE, J., and HARRISON, J. H., "Cleaning blast furnace and other gases." April 15.
9386.—CRUICKSHANKS, W., "Making gas from petrol." April 18.
9403.—CARRON, A., "Separating the oils from the pitch of tar." April 18.
9450.—GOODSON, J. H., "Gas-pressure governor." April 18.
9513.—ROGERS, R. A., "Ovens for gas." April 19.
9533.—WYNER, A., "Gas-kindling devices." April 19.
9550.—BIRAULT, C., and RICHÉ, H., "Production of combustible fuel gases," April 19.
9570.—HOLDEN, E. C., "Gas-engines." April 19.
9609.—VIS, G. N., "Manufacture of sulphate of ammonium." April 20.
9610.—CHADBORN, F. C., "Burners." April 20.
9624.—WYNER, A., "Kindling devices for gas-ovens." April 20.
9627.—NORTH, R. B., "Controlling the supply of gas to burners." April 20.
9632.—HIBY, W., "Purification of gas." April 20.
9651.—ROSTIN, H. P., "Gas-igniting apparatus." April 20.
9688.—KEITH, J. & G., "Gas-lamps." April 21.
9707.—WALLACH BROS., LTD., and GREATOREX, W. H., "Valves." April 21.
9759.—BITTMANN, H., "Charging furnaces." April 21.
9761.—BROOK, F. H., "Valves and cocks." April 22.

Petersfield Water-Works Extensions.—The Local Government Board have approved of the scheme prepared by Mr. Harry W. Taylor, Assoc.M.Inst.C.E. (Messrs. Taylor, Wallin, and Taylor), of Newcastle, for the extension of the water-works at Petersfield. The scheme consists of tapping springs in the chalk measures, constructing intake works, laying several miles of pipes from the springs to the town, making ferro-concrete works at the reservoirs, &c. The Urban District Council have given instructions for tenders to be invited at once for the execution of the works.

Gas-Meter Testing in Middlesex.—In the annual report of the working by the Middlesex County Council of the gas-meter testing-station in Upper Edmonton, it is stated that during the eleven years the Sale of Gas Acts, 1859 and 1860, have been in operation in the county, 849,556 meters have been tested, and fees amounting to £25,733 received. In the year lately ended, 73,555 meters were tested at the minimum fee of 6d. each; 13,992 at 1s. each; and the remainder at fees varying from 2s. for an 80-light to 33s. for a 1000-light meter. The amount of fees received for the twelve months was £2682 for 88,321 meters, against the totals of £2497 and 82,184 meters for the previous year. Of the 5936 meters received from gas companies and consumers, 1939 were stamped and 3997 rejected. Of the 82,385 meters received from makers, 80,086 were stamped and 2299 rejected.

MISCELLANEOUS NEWS.

EXAMINATION IN "GAS ENGINEERING."

The City and Guilds of London Question Paper.

The first of the examinations in subjects connected with the gas industry held annually under the auspices of the City and Guilds of London Institute took place on Saturday, when candidates were required to answer the following questions in "Gas Engineering" set by Mr. Thomas Glover, of Norwich, the Examiner. The candidates were directed to confine themselves to one grade only, and not to attempt to answer more than eight questions in the four hours allowed. The maximum number of marks obtainable is appended to each question.

HONOURS GRADE.

1. In what form of combination is sulphur usually found in coal? Give an approximate balance-sheet showing the distribution of the sulphur in the gas, and in each of the residuals, after carbonizing an ordinary gas coal containing an average quantity of sulphur. [35.]

2. Describe, by the aid of sketches, any efficient form of "regenerator" used in conjunction with a "producer" or "generator" for heating a retort-setting. Give the approximate area of air-heating surface per ton of fuel consumed per diem, and the temperature of the gases entering the regenerator and entering the main flue. [45.]

3. Give a description of the Fiddes-Aldridge stoking-machine, with detailed sketches of that portion of the mechanism which enters the retorts. [45.]

or, Describe, by the aid of sketches, the discharge ends and discharging mechanism of two forms of continuously worked vertical retorts. [45.]

4. Explain, by the aid of sketches, the principle of the Dillamore tar-column, and its application to the adjustment of seals in hydraulic mains. Enumerate the advantages and disadvantages of this method of adjusting seals, and state what precautions in designing and working it is necessary to observe. [40.]

5. Draw a cross section of a Pelouze and Audouin apparatus; explain its function, its action, and its position relative to the other apparatus used for cleansing the crude gas. [40.]

6. How do the results obtained from the carbonization of heavy charges in long periods vary from those obtained when light charges are carbonized in short periods? What classes of coals are most advantageously carbonized by each of the two systems, and why? [35.]

7. Describe any well-known gas-calorimeter and the methods of testing. Show, by figures, what would be the effect on the calorific value of (*a*) drawing in, by over-exhausting, 8 per cent. of furnace gases; or (*b*) adding 15 per cent. of blue water gas to a high-grade coal gas. [35.]

8. State how the quality of coal and carbonizing conditions affect the production of naphthalene. Give a brief description of the methods usually employed to reduce the quantity contained as vapour in the gas, or to prevent its deposition in a solid form in the distributing mains. [35.]

9. What is the function of a safety governor? In what position and under what conditions is it usually fixed relative to the gasholder valves and ordinary station governors? [35.]

10. Explain the construction of the "London" No. 1 standard test-burner. State the nature of its defects as a "standard," and how these have been overcome in designing the No. 2 "Metropolitan" burner. [30.]

ORDINARY GRADE.

1. Describe the method you would adopt for accurately estimating the quantity of sulphur contained in a sample of coal, and show the chemical formulæ on which the results are worked out. [35.]

2. Sketch a front sectional elevation, above the retort-house floor line, of two main arches filled in with two settings of differing type of seven retorts. Show the principal measurements, and state any advantage one type of setting has over the other. [45.]

3. Draw a cross section of a hydraulic main, showing a dip-pipe in position, a method of adjusting the depth of the sealing liquid, and the connections for drawing off the tar. [35.]

4. Sketch any form of expansion joint in use on foul mains. Under what circumstances is it advisable to provide such a joint? [30.]

5. Draw a cross section of a Livesey washer. Explain its function, its action, and its position relative to the other apparatus used for cleansing the crude gas. [45.]

6. Give the approximate weight in pounds of the liquid, gaseous, and solid products obtained from 2240 lbs. of coal when carbonized at a temperature to yield 11,000 cubic feet of purified gas. [40.]

7. Give a description of the test for ascertaining the percentage of sulphur in spent oxide. What precautions would you take to avoid estimating dissolved tarry matter as sulphur? [40.]

8. Decribe a 60-inch open bar photometer, and the method of testing (*a*) the illuminating power of ordinary town gas; (*b*) the light-giving power of an upright incandescent mantle burner. [40.]

9. How would you ascertain the percentage of ammonia contained in a sample of sulphate of ammonia? [30.]

10. Describe a differential pressure-gauge, and state under what conditions of service it is most usefully employed. [30.]

The examination in "Gas Supply" will be held next Saturday, when the candidates will be required to deal with the questions set by Mr. J. H. Brearley, of Longwood, the Examiner.

By the use of automatic public lighting at Hurstpierpoint, a saving of £7 on the past quarter has been reported by the Parish Council. Hopes are entertained that during the lighting season the system will economize the consumption of gas to the extent of £34 or £35.

BRITISH COALITE, LIMITED.

Financial Difficulties—Another Adjournment.

The Adjourned Ordinary General Meeting of this Company was held at the Liverpool Street Station Hotel last Wednesday—Sir WILLIAM H. PREECE, K.C.B. (the Chairman), presiding.

The SECRETARY (Mr. Acton Phillips) having read the notice convening the meeting, and also the report of the Auditors,

The CHAIRMAN first explained that, in conseqence of ill-health, he had been spending some time in South Africa, and had just returned to London. He wished it to be thoroughly understood that he had nothing whatever to do with the promotion of the Company. He had put hard cash into it, and also into Coalite, Limited; and he felt so strongly with regard to the value and advantages of coalite that he had not hesitated to take up £1000 of the debentures. Feeling, however, that there was something wrong, the Directors appointed a Committee of Inquiry, consisting of three gentlemen who were not members of the Board. The Committee visited every place in the country where the Company had works; and their recommendations met with the entire approval of the Board. Things, however, were still not very promising; and they wanted more capital. The help of the Investment Registry was called in, and they advised the Directors to appoint a Managing-Director. The Directors left the selection of the man to the Investment Registry; and they recommended Mr. Herman Clarke, who had tackled the matter in a bold way, and whose report had been circulated. [See *ante*, p. 241.] The Board had been most assiduous in their work; but they had lost a good many of their early Directors—in fact, he was the only original member of the Board remaining in office. He had often wished to retire; but he would not have liked it to be said that he acted the part of a coward. He had gone into the thing very closely, and he was going to stick to the Company as long as he could, and assist it to get out of its difficulties. His scientific views regarding coalite were well known. They had never been really attacked; but they had been supported by one of the first authorities in Germany and by Professor Armstrong, one of the chief chemists in this country, and now they were supported by no less an authority than Mr. Clarke. There was nothing wrong with the system; and the patents were as sound as ever.

THE FINANCIAL POSITION.

Dealing with the balance-sheet, the Chairman said the calls in arrear, as per last account, were £233,551. The amount of calls payable by Coalite, Limited, on 226,246 shares released in settlement with that Company, was set out; leaving a small balance of unpaid calls of £539. When addressing the shareholders in December, 1909, he stated that the Directors had received from Coalite, Limited, since the close of the previous financial year, the sum of £62,500, and that they were satisfied the remaining outstanding amount would be liquidated early in 1910. His authority for making this statement was a letter written by Coalite, Limited. Subsequent events, however, altered the situation. Negotiations which Coalite, Limited, expected to bring to a satisfactory conclusion failed; and as further capital was urgently required to meet their commitments, an issue of £300,000 first mortgage debentures was decided upon. The Investment Registry were approached with a view to purchasing the whole £300,000; but they stipulated that, before any issue was made, the position between Coalite, Limited, and the Company would have to be cleared up. And, acting under legal advice, an arrangement with Coalite, Limited, was entered into. [The Chairman explained the nature of the arrangement, and also the changes which had taken place on the credit side of the balance-sheet.] Upon the development of the conditions set forth in the Managing-Director's report, the Investment Registry refused to proceed with the advance of £300,000, and made a demand upon the Board for the repayment of the moneys already advanced to the Company, amounting to about £75,000. As the Board were not in a position to repay these advances, a supplemental agreement was entered into, providing that in any event the issue of debentures should be limited to £125,000, but that only £75,000 of this amount should be taken until a Committee, consisting of Lord Elcho, a Director of the Investment Registry, Mr. Frank Bryce, and the Managing-Director, should report that, upon the expenditure of a further £50,000, the Company could within two years earn at least £15,000 per annum. The time in which this report was to be made, however, was limited to Feb. 1, 1911. Unfortunately, on that date the Committee were not in a position to so report; and the Investment Registry entered into a new agreement with the Company, whereby, in consideration of the Company depositing in the hands of the Trustees the interest due on July 1, 1911, on the £75,000 of debentures, and agreeing to limit the issue of the debentures to £75,000, they extended the time for payment of the advances made until May 1, 1911. Since Feb. 1, it had been demonstrated to the satisfaction of the Board that, with the expenditure of further capital to the extent of £50,000, the Company could, they believe, earn at least £15,000 per annum; and the Directors had been in negotiation throughout this period with the idea of raising the money. Unfortunately, they had been unable to do so; and negotiations were entered into with the Investment Registry for a further extension of the time. The conditions insisted upon by them, however, were so stringent that the Directors had not been able to meet them; and the Company stood in the position that, unless they could repay the Investment Registry on the 1st of May the £75,000 of their advances, the Trustees for the debenture-holders could apply to the Court for the appointment of a Receiver. The Directors, however, had good reason for believing that a satisfactory settlement would even now be reached, in which case it was more than probable that they would have to call the shareholders together again. The Chairman concluded by formally moving the adoption of the report and accounts.

THE MANAGING-DIRECTOR ON THE COMPANY'S WORK.

The MANAGING-DIRECTOR (Mr. Herman Clarke), in seconding the motion, explained in some detail the conditions which had brought about the present situation. He remarked that, unfortunately, the Company's process was misunderstood from the start. The Board and their technical advisers believed they had a process which would be of assistance to, or was allied with, the gas-producing industry; and they entered into contracts with the Gas Companies at Hythe and Plymouth to deliver certain quantities of gas at fixed prices—taking the coalite, after payment of all expenses, and the bye-products, with the exception of the sulphate of ammonia, as their payment. Owing, however, to the warm climate of Plymouth, there were only about four months of the year in which the people wanted fuel. The consequence was that there was an over-production of coalite and an under-production of gas; and the cost of coal for producing the gas was too high to allow of it being sold profitably. The quantity of gas was not up to the contract; and the Plymouth Gas Company insisted that the Company should either put in a battery which would carry out the contract, or that the Company should remove the plant, pay £1000 as damages, and provide for other damages which might arise, due to the contract extending over some 21 years. Last autumn they arranged to abandon the contract, on which they were losing some £25 or £30 per day; paying the Plymouth Company, in lieu of the gas which they should have delivered, £5 a day. The whole contract was to terminate on April 30; and the Company were to remove a certain portion of the plant, which they were doing. At Hythe, the conditions were practically similar; but at Wednesfield they were somewhat different. The price of domestic fuel was so cheap that the Company could not make a profit on the production of coalite; and consequently the plant was shut down. At Barking, he had reduced costs to a point where they were within reach of a profit, even under the old form of operation. The one fatal mistake made had been that the technical staff who were carrying out the process did not recognize the point of heat at which coalite could be produced commercially on an economical scale. They carbonized at too low a heat; the result being that they produced a fuel which could not be handled commercially– being so soft that, when shipped, it fell to pieces. They had been obliged to increase the heat, and go back to the original process; using a fire clay retort of the general design as now employed by coke-ovens all over the world. This was producing in actual practice, on a full-sized scale, coalite which showed 69 per cent. of effective fuel of a character hard enough to deliver to the customer, and which was free-burning and free-lighting. They were producing gas to the extent of more than 7000 instead of 5000 cubic feet per ton of coal carbonized; and this had a value as a power gas one-third greater than any gas produced by coke-ovens or gas companies. They were producing sulphate of ammonia nearly up to the position of other carbonizers of coal; and tar which had passed from the paraffin series into the very profitable benzol series. They had put themselves into a position where, with anything like intelligent management—management which could be carried on by any ordinary competent gas or coke-oven engineers—they could produce coalite by a process which was more valuable than any other form of carbonization of coal. He was really quite pessimistic regarding the matter when he started; but no man could look into the coalite process and study it without becoming optimistic. He had only been dealing with the matter for eight or nine months, but he thought he had shown some ability to handle it. He had cut down expenses from £40,000 or £50,000 a year to next to nothing. He took hold of it when it was practically wrecked, and he thought he had put it in the way of getting on its feet, at any rate. He did not mean to say they were out of the wood yet, by a good deal. There were lots of things still to be learned and done. But they were merely details, and when they were carried out—and if they were not carried out by the Company they would be by somebody else—the process would be established as a lasting one. The whole point was that the thing must be handled with intelligence and in a business-like way; and, given these conditions, it could unquestionably be made a great commercial success.

SHAREHOLDER CRITICIZES MANAGEMENT AND MOVES ADJOURNMENT.

Mr. H. FISHER, J.P. (of Sheffield), said the *crux* of the matter was that since the shareholders last met the Company had lost a further £40,000. In the previous year's report, they were told that the Directors had the fullest confidence in the immediate financial success of the undertaking; that very extensive plant was being erected at Barking, Wednesfield, Plymouth, and Hythe; that the foundry was turning out excellent work; that the Plymouth and Hythe plants were giving steady returns; and that further contracts with other gas companies were being negotiated. How did this compare with the facts now disclosed? He imagined that no body of shareholders were ever so bewildered with printed matter, experts' reports, chemical analyses, &c., as the unfortunate shareholders in the British Coalite Company. After all the expert advice they had received, they were now told that everywhere but at Barking the local conditions were such as made the coalite business commercially unprofitable. In his opinion, the shareholders should be told what the negotiations, which were not yet concluded, were all about; they should not be kept any longer in the dark. He concluded by moving the following amendment: "That this meeting be adjourned for two months, to enable the Board to continue the negotiations referred to in the report as now pending; that, in view of the failure, after over three years' experiments and experience, to make a success of the Company, the Directors be asked to consider the advisability of winding it up, in order to avoid further loss; and that they report thereon to the adjourned meeting."

A SHAREHOLDER seconded the amendment.

SOME PERTINENT QUESTIONS.

The MANAGING-DIRECTOR, in reply to various questions, said he had not included anything in his report for receipts from gas sold; not because it was not valuable, but because he had no one to sell it to at the moment. As a matter of fact, it was a valuable product; and he was obtaining its full value by burning it under the boilers—developing power to operate the plant. There were no terms of arrangement with the Investment Registry as to the payment of the £75,000 by the 1st of May, except that they should pay it. The Registry had not threatened them with a Receiver. The Directors were in negotiation with them, and he believed an arrangement would be made to carry the loan beyond the date at present fixed. The interest payable in July had already been deposited. The valuation put upon the freehold property at Barking was virtually £144,500. It cost about £140,000; and the

Company had put permanent improvements upon it, consisting of roads, jetties, &c., to the amount of about £20,000.

AN ADJOURNMENT DECIDED UPON.

After some further discussion,

The CHAIRMAN stated that Mr. Fisher had consented to the deletion from his amendment of the sentence as to the failure to make a success of the Company; and with this alteration, and the insertion of the date to which the meeting should be adjourned—to Wednesday, July 5, at 12.30 p.m.—he would put the amendment to the meeting.

Upon a show of hands being taken, the amendment was carried unanimously.

A suggestion was made that a Committee of shareholders should be appointed. The Chairman intimated that the Directors were quite willing for two or three shareholders to act as a Committee to consult with them. No names, however, were brought before the meeting.

The Coalite Fiasco.

In the course of an article under the above heading, the "Iron and Coal Trades Review" last Friday said:

The latest official documents issued to its shareholders by the British Coalite Company, Limited, are certainly of a most disappointing character; and notwithstanding the invincible optimism of the Managing-Director and the rest of the Board, the outlook does not seem to be a particularly bright one now. Rarely has a company been inaugurated with such an imposing flourish of trumpets, and rarely has a company managed to accomplish so little. It is now over three years since operations were commenced, and the imagination of the investing public was fired by the accounts published in advertisement form of the wonderful things that were to be accomplished and of the golden harvest that was to be reaped from the working of the Parker patents. The new fuel was to be manufactured by millions of tons, and it was to practically supersede coal in London for household purposes. It was to give a Smokeless Metropolis; to "bring to fruition the hopes of those who have written, preached, and striven for a cleaner life and a purer atmosphere." In fact, the consumption of the new fuel was to be a sort of national religious duty according to the eloquent periods of the picturesque puffs preliminary. . . . The latest development is the issue of the reports of the Directors and Managing-Director already referred to, which unfold a melancholy tale. The contemplated contracts with gas companies have been cancelled; the expensive Wednesfield, Plymouth, and Hythe plants have been closed down; and the whole of the Company's energies are to be concentrated upon the Barking works. As to the financial position of the Company at present, the report for the year ended Sept. 30 shows a loss for that period of over £45,000; making a total deficit on working account to date of more than £100,000, excluding the loss incurred in connection with the construction of the works at Wednesfield, Hythe, and Plymouth. With regard to the future, the Managing-Director states that the whole of the sole remaining plant at Barking requires to be reconstructed; and he estimates that to erect plant capable of carbonizing 300 tons of coal per day, and to provide the necessary working capital, £50,000 will be required. How are the mighty fallen! How modest a proposal when we come to think of the talk of millions of tons of coalite originally indulged in! It is clear, however, that, whatever the merits or demerits of the fuel itself, the affairs of the Company have been mismanaged, both financially and technically; and, in view of what has happened in the past, it cannot be said that the statements now made with regard to future success are very convincing, although a new point of temperature has been decided upon, which "is commercially efficient in the production of a free lighting, smokeless fuel from the carbonization of bituminous coal, taking into consideration the fuel itself, the gas, the tar distillates, and the ammonia produced." This is an admission, of course, that the wrong point has been adhered to hitherto. At any rate, it does not appear that there is any immediate prospect of the fuel competing very seriously with coal, despite the alleged "enormous demand" for the former; of the gas companies finding their occupation gone because of its production of gas; or of the bye-product market being disorganized by the enormous make at Barking. Indeed, it was suggested at the meeting on Wednesday that the question of winding-up and avoiding further loss should be taken into consideration; and it is possible the Board may decide to adopt this course.

Projected Extension of Odessa Gas-Works.—The British Acting Consul-General at Odessa (Mr. G. N. Martin) reports that the municipal authorities of the city intend to rebuild and enlarge the gas-works; but that it has not yet been decided whether the work shall be done by them or under a concession.

Shepshed Gas Supply.—At the meeting of the Shepshed Urban District Council last Tuesday, the Clerk presented the annual statement in regard to the work of the Gas Department in the past financial year. It showed that there had been an increase of £50 in the gas rates, compared with the preceding year; and the leakage had been reduced by 391,000 cubic feet. There had been a saving of about £30 on the public lighting, owing to the change from ordinary to incandescent burners. The gross profit was £800; and after meeting the repayments on account of loans and the sinking fund, there would be a balance, with the £53 brought forward, of £353. It was decided to reduce the price of gas 3d. per 1000 cubic feet.

Yeovil Gas Supply.—The profit on the working of the gas undertaking of the Yeovil Corporation in the year ended the 31st of March was £5073; and after meeting the interest and sinking fund payments, &c., there was a balance of £226 to carry forward. The quantity of gas made was 82,357,000 cubic feet (an increase of 7·7 per cent.), or at the rate of 11,713 cubic feet per ton of coal, of which 10,770 cubic feet were sold. The Gas Committee in their report recommended a reduction of 2d. per 1000 cubic feet in the price of gas as from the 31st of March, making it 3s. net, and also a reduction of 1s. 4d. in the annual charge for each public lamp. The Committee expressed regret that the extensive sewerage works in the town had resulted in considerable damage to the mains.

MANCHESTER AND ITS FINANCES.

Contributions from Profit-Earning Departments in Aid of Rates.

The following notice of motion will be brought by the Lord Mayor before the Manchester City Council at their meeting to-morrow: "That a Special Committee be appointed to consider and report to this Council as to the basis on which each trading Committee of the Corporation should make contributions in aid of the city rates." There is also on the *agenda* a resolution in the name of Mr. Abbott, who asks that the Finance Committee shall be instructed to consider and recommend to the Council the amount of the city rate to be levied for expenditure to be incurred during the financial year ending March 31, 1912, before the estimates of the several Committees are approved by the Council. It is generally understood that these resolutions are being put forward because of an announcement made by Alderman Copeland, the Chairman of the Finance Committee, that, though the Corporation Committees, at the request of the Finance Committee, have revised their original estimates to the extent of securing a saving of £22,692, there are certain reasons, over and above the various Committees' requirements, that necessitate an increase in the city rate. This statement was made to the Press at the conclusion of a meeting of the Finance Committee last Thursday, and has caused a good deal of surprise in the city, as practically everybody was looking forward to a slight decrease, especially as the profit-earning departments were handing over larger sums this year than last in relief of rates—the Gas Committee giving £50,000, compared with £46,500; and the Electricity Committee £19,496, against £15,000. As stated in the "JOURNAL" last week, the Electricity Committee have decided upon a new method of allocating the profits of the department in relief of rates. The contribution is to be on the basis of 1 per cent. on the amount of the outstanding indebtedness of the undertaking.

The impression in well-informed circles in Manchester is that an increase in the rates has been rendered necessary mainly because the Finance Act of last session has brought about a reduced income from licensed properties. Alderman Copeland says the reasons for the increase will be set out in a special report to the City Council.

THE SMOKE ABATEMENT CAMPAIGN IN MANCHESTER.

Cheaper Gas Advocated to Remedy the Evil.

A Meeting called by the Manchester and Salford Smoke Abatement Society was held at the Midland Hotel, Manchester, on Friday, when a resolution was adopted approving of a Smoke Abatement Exhibition being held in the City next November. It was also decided to form an Advisory Committee to promote the question of smoke abatement in the city, and see to the arrangements for the exhibition, which will be held in the City Exhibition Hall. Alderman Fildes, the Chairman of the Sanitary Committee of the Manchester Corporation, who presided, remarked that the Gas Committees of Manchester and Salford could help much in the campaign against smoke pollution by encouraging the use of gas for many purposes. The Manchester Gas Committee were anxious to do this; but the City Council, by insisting on so large a proportion of the gas profits being allocated in relief of the rates, prevented the provision of cheap gas and the consequent general use of gas-fires. Alderman Gibson, the Chairman of the Gas Committee, had for years wished to reduce the price of gas for heating purposes. There ought to be a reduction; and he (Alderman Fildes) was certain that if pressure came from the outside it would be obtained. It would, of course, mean a cost to the rates; but the citizens ought to be willing to pay more if by doing so the high death-rate could be reduced. Was it not better to save lives than rates?

Professor J. W. Graham said there were only two things which would to any large extent mitigate the smoke evil, one being the extension of the use of gas; and this was dependent upon its cheapness. He was of opinion that the Manchester Corporation could sell gas at 1s. 9d. per 1000 cubic feet with little risk of loss. Another way of reducing the smoke evil was to supply smokeless fuel; and he suggested that such fuel might be made by the Corporation at their gas-works.

BLACKPOOL CORPORATION GAS UNDERTAKING.

Large Profit on the Past Year's Work.

Mr. John Chew, the Gas Engineer and Manager of the Blackpool Corporation, has been able to present to his Committee an exceedingly satisfactory report for the year ended the 31st of March last. The total income was £90,568, and the expenditure £65,396; leaving a surplus of £25,172. After meeting interest charges, &c., there is available a sum of £11,811 for the relief of the rates, compared with £9557 for 1909-10. At the beginning of the financial year, it was estimated that the income would be £85,937; the expenditure, £65,076; and the profit, £7500. Consequently, the income has increased by £4631, the expenditure by £320, and the profit by £4311. The output of gas was 569 million cubic feet, compared with 550 millions in the year ended March 31, 1910; and the quantity sold was 560 millions—428 new consumers being added. The capital outlay on the gas undertaking up to the end of March was £211,406; the sinking fund stands at £82,507, and the reserve fund at £9729. It is estimated that in the current year the profit will be £10,500, on an income of £88,931. It has been intimated to the Committee that during the period Mr. Chew has been Manager—that is to say, ever since the Corporation became possessed of the gas-works—the undertaking has yielded an aggregate profit of £294,000.

Referring to the profit realized on the past year's working, a local paper characterizes it as a "remarkable achievement," and says: "This great increase in the profits is in face of the rise in the price of coal at the beginning of the year, which made a difference of something like £2000; while there was also a dropping market for residuals, and

little prospect of a greater demand for gas. The latter, however, was counteracted by the stronger market that prevailed in the latter half of the year, when full advantage was taken of the opportunity to clear the stocks and to increase the receipts from this source. The large margin of profit is chiefly accounted for by the way the works have been kept in an up-to-date condition by the introduction of the most recent improvements in manufacturing appliances, and thus effecting many economies in labour." With regard to the aggregate profit of £294,000 yielded by the gas undertaking since it has been in the hands of the Corporation, it is regarded as a record of which they and Mr. Chew "have every reason to be proud;" and the hope is expressed that "similar success will attend their efforts in the future."

GAS AND WATER FINANCE AT STALYBRIDGE.

A Special Meeting of the Stalybridge Town Council was held a few days ago, when the estimates of the various Committees for the coming financial year were considered. Mr. Hague, who moved the adoption of the estimates and the levying of a total rate of 6s. 2d. in the pound for the original borough, and 6s. 1d. for the added portion—an increase of 1d. in the pound on last year—explained that the Gas Department were contributing £1898 out of profits in aid of rates, against £1755 before. With regard to the water-works account, he said it was estimated a year ago that the deficiency would be £670, which could be met out of existing reserves. But, owing to receipts on account of net revenue derived from the Joint Committee amounting to only £6370, compared with an estimated £7500, the actual deficiency was £1815. Of this sum, £1316 was being met by a transfer from the reserve, which was now exhausted, and the balance (£499) was to be met out of a special rate of 1d. in the pound levied within the area of the original borough. Mr. Hague added that the last occasion it was necessary to aid this account by rate was 1887, when 3d. in the pound was levied; and as the deficiency estimated at March 25, 1912, was £1910, he was sorry to say that next year they would have to put on a water-rate of 5d. in the pound. Alderman J. Ridyard, in seconding the motion, said he had a letter asking him to request the Gas Committee of the Corporation to reduce the price of gas; but it seemed to him that the people who were agitating for cheaper gas did not realize that, if the charge was lowered, they would have to pay more in rates. Mr. T. Cooke did not agreed with the latter statement. He said, by paying the present price for gas, and making a profit which might ease the rates to the extent of 3d. in the pound, the gas consumers were relieving by this sum the people who used electricity. Alderman Ridyard said this was not so; for, as the gas-works were owned by the ratepayers, it was they who would have to bear the cost of sinking fund and other charges according to Act of Parliament. The estimates were adopted; and the rate was fixed as named.

Commencing yesterday, lectures on cooking by gas are being given this week, in the offices of the Cambridge Gas Company, by Mrs. Bernard Buckham, who is using a Richmond cooker.

SOUTH BARRACAS (BUENOS AYRES) GAS COMPANY.

Presiding at the Twenty-First Ordinary General Meeting of the Company—held last Tuesday at the London Offices, No. 1, East India Avenue, Leadenhall Street, E.C.—Mr. J. C. im Thurn referred with regret to the resignation, owing to ill-health, of Mr. F. J. Heseltine, who had for many years been on the Board of the Company.

Proceeding to move the adoption of the report (as noticed in last week's "JOURNAL," p. 248), he said the Directors would have been glad if the net results had been better; but when the shareholders heard the reasons he had to give, he thought they would be satisfied. All, or very nearly all, of them, he believed, were shareholders in the Buenos Ayres (New) Gas Company, Limited, and participated in the benefits of its amalgamation with the other Companies in Buenos Ayres. They would therefore be able to appreciate the fact that this step, of necessity, caused considerable dislocation in the affairs of the South Barracas Company, which was not only owned, but also managed, by the Buenos Ayres (New) Gas Company. Without any extra cost to itself, the latter Company were able to assist them in many ways which helped to reduce the working expenses. This help being no longer available, the South Barracas Company had had to organize a competent staff to give the necessary careful attention to the business. They were fortunate in having secured the services as Manager of Mr. J. H. Darrah, who was doing good work in re-organizing the affairs of the Company on a basis which would be sufficient to deal with a considerably larger business. With regard to public lighting, the advantages of the inverted mantle system were becoming greatly appreciated, and there had been an increase during the year of 71 public lamps. They were changing as rapidly as possible all the street-lamps to this system. Every effort was being made to extend this department; and an installation of high-pressure gas-lamps, with the necessary compressors, had been shipped out. It would be noted from the balance-sheet that there was an available balance of £24,301, from which £5000 had been placed to reserve; making the total standing to this account £10,000. The Directors now recommended a dividend at the rate of 4 per cent. per annum, free of income-tax (of which 2 per cent. was distributed in October), together with a bonus, also free of income-tax, of 1 per cent. upon the total capital issued. This would absorb £8333, and leave £10,968 to be carried forward. The net trading profit for the year was some £6000 less than in 1909—this difference arising principally from the increased cost of the new administration (amounting to about £2000), and from the greatly enhanced cost of coal and freight (amounting to some £4000). The increased cost of administration would gradually disappear as the Company's business developed. The output of gas in 1910 exceeded that of 1909 by nearly 4 million cubic feet; and the receipts for residuals also showed a considerable increase. A further satisfactory feature was that the gas sales alone during the first three months of the current year exhibited a substantial gain of 15 per cent. over the corresponding period of the previous year. Owing to the development of the water-works promoted by their Company, which were now beginning to supply the public in the districts the Company served, these suburbs were being rapidly

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 279.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	83—86	..	5 16 3
374,000	Stk.	Jan. 13	4	Do. 4 p.c. Deb.	95—97	..	4 2 6
200,000	5	Oct. 28	7	Bombay, Ltd.	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	5½—6	..	4 13 4
50,000	10	Feb. 24	15	Bourne-mouth Gas & Water Pref. 6 p.c.	28—29	..	5 3 5
311,810	10	,,	7		16—16½	..	4 4 10
75,000	10	,,	6		14½—15	..	4 0 0
380,000	Stk.	,,	12½	Brentford Consolidated	254—257	..	4 18 3
330,000	,,	,,	9½	Do. New	198—200	+½	4 15 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	122—124	..	4 0 8
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb.	99—101	+1	3 19 3
220,000	Stk.	Mar. 10	11	Brighton & Hove Orig.	215—218	..	5 0 11
246,320	,,	,,	8	Do. A Ord. Stk.	155—158	..	5 1 3
460,000	20	Apl. 12	10⅝	British	43¾—44½	..	4 15 4
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	96—98	..	4 1 8
109,000	,,	Feb. 10	6	Bromley, A 5 p.c.	116—118	..	5 1 8
165,700	,,	,,	4½	Do. B 3½ p.c.	87—89	..	5 1 2
82,278	,,	,,	5½	Do. C 5 p.c.	106—108	..	5 1 10
55,000	,,	Dec. 30	3½	Do. 3½ p.c. Deb.	84—86	..	4 1 5
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	96—98	..	4 1 8
100,000	10	—	—	Cape Town & Dis., Ltd.	3½—4½	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	6—6½	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	—	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	88—90	..	5 0 0
157,150	Stk.	Feb. 24	5	Chester 5 p.c. Ord.	109—111	..	4 10 1
1,513,280	Stk.	,,	5/9/4	Commercial 4 p.c. Stk.	113—116	..	4 14 3
560,000	,,	,,	5½	Do. 3½ p.c. do.	108—110	..	4 16 11
475,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	77—79	..	3 15 11
800,000	Stk.	,,	4	Continental Union, Ltd.	95—97	..	4 2 6
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—138	..	5 1 5
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
148,995	,,	Apl. 12	5	East Hull 5 p.c. Ord.	101—103	..	4 17 1
840,150	10	Jan. 27	10	European, Ltd.	19—20	−½	5 0 0
16,179,445	Stk.	Feb. 24	4¾	Gas-light and Coke 4 p.c. Ord.	105½—106½	..	4 7 7
2,600,000	,,	,,	3½	3½ p.c. max.	85—87	..	4 0 6
4,062,235	,,	,,	4	4 p.c. Con. Pref.	101—103	..	3 17 8
4,531,705	,,	Dec. 15	3	3 p.c. Con. Deb.	79—81	..	3 14 1
258,740	Stk.	Mar. 10	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 5
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Apl. 27	11	Hongkong & China, Ltd.	17—17½*	..	6 5 8
131,000	Stk.	Mar. 10	7⅜	Ilford A and C	143—146	..	5 1 0
65,780	,,	,,	5½	Do. B	113—115	..	5 2 2
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	96—98	..	4 1 8

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
4,940,000	Stk.	Nov. 11	9	Imperial Continental	191—193	..	4 13 3
1,235,000	Stk.	Feb. 10	3½	Do. 3½ p.c. Deb. Red.	92—94	..	3 14 6
200,242	Stk.	Mar. 10	6	Lea Bridge Ord. 5 p.c.	119—121	..	4 19 2
561,000	Stk.	Feb. 24	10	Liverpool United A.	214—216	..	4 12 7
718,100	,,	,,	7	Do. B.	163—165	..	4 4 10
306,083	,,	Dec. 30	4	Do. Deb. Stk.	102½—104½	..	3 16 7
75,000	5	Dec. 15	6	Malta & Mediterranean	4½—5	..	6 0 0
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video, Ltd.	13—13½	..	5 3 8
1,775,892	Stk.	Feb. 24	4½	Newc'tle&G'tesh'd Con.	101—103	..	4 5 0
529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	89—90	..	3 17 9
55,940	10	Mar. 10	7	North Middlesex 7 p.c.	14½—15½	..	4 10 4
300,000	Stk.	Apl. 27	8	Oriental, Ltd.	136—138*	+½	5 15 11
60,000	5	Apl. 12	8	Ottoman, Ltd.	6⅞—7¼	..	5 10 4
31,800	53	Feb. 24	13	Portsea Island A	135—140	..	4 18 4
60,000	50	,,	13	Do. B	125—130	..	5 0 0
100,000	50	,,	12	Do. C	120—125	..	4 16 0
114,800	50	,,	10	Do. D and E.	102—105	..	4 15 3
398,490	5	Oct. 28	7	Primitiva Ord.	7⅞—8	..	4 7 6
796,980	5	Dec. 30	5	Do. 5 p.c. Pref.	5¼—5½	..	4 10 11
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
312,650	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	96—98	..	4 1 8
250,000	10	Mar. 24	9	San Paulo, Ltd.	15⅞—16¼	..	5 10 9
115,000	10	,,	6	Do. 6 p.c. Pref.	11½—12	..	5 0 0
125,000	50	Jan. 3	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
135,000	Stk.	Mar. 24	10	Sheffield A	235—237	..	4 4 5
209,984	,,	,,	10	Do. B	235—237	..	4 4 5
523,500	,,	,,	10	Do. C	234—236	..	4 4 9
70,000	10	Oct. 14	6	South African	9—10	−1¼	6 0 0
6,429,895	Stk.	Feb. 10	5/9/4	South Met., 4 p.c. Ord.	119—121	..	4 10 3
1,895,445	,,	Jan. 13	3	Do. 3 p.c. Deb.	79—81	..	3 14 1
209,820	Stk.	Mar. 10	8	South Shields Con. Stk.	154—156	+1	5 2 7
605,000	Stk.	Feb. 24	5⅜	S'th Suburb'n Ord. 5 p.c.	119—121	..	4 13 6
60,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
117,058	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	122—124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	111—113	..	4 8 6
120,000	Stk.	Feb. 10	7	Tottenham A 5 p.c. and B 3½ p.c.	141—143	..	4 17 11
483,940	,,	,,	5½		115—117	..	4 14 0
149,470	,,	Dec. 15	4	Edmonton 4 p.c. Deb.	98—100	..	4 0 0
182,380	10	Dec. 30	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	Jan. 3	5	Do. 5 p.c. Deb. Red.	98—100	..	5 0 0
236,476	Stk.	Feb. 24	5	Tynemouth, 5 p.c. max.	114—116	+2½	4 6 2
255,636	Stk.	Feb. 24	6¾	Wands-worth B 3½ p.c.	141—143	..	4 14 5
85,766	,,	Dec. 30	3	3 p.c. Deb. Stk.	73—75	..	4 0 0

Prices marked * are "Ex. div."

developed and built-up. The Directors therefore had every confidence in the future success of the undertaking. The only uncertain factor was the cost of coal and freight; but this they hoped would ere long be reduced to more normal figures. There was a strong Local Committee, one of the members of which was present that day, and would perhaps give his opinion of the Company's prospects. A further issue of 50,000 shares was made in October, the proceeds of which were chiefly applied to reducing the loan at the bank. On the credit side there appeared an item of £19,594, additions to property account. This consisted of large extensions of mains, the provision of new retorts, and the installation of a carburetted water-gas plant. There were now 106 miles of main in service, including 4 miles of high-pressure main laid to assist the gas pressure at the far end of the district. Relations with the various municipalities continued cordial; and the year had been free from labour troubles. The only other matter which he thought it would interest the shareholders to hear was that a short time ago the Board sent the Secretary (Mr. W. Upton) over to South America. He had returned recently, and reported encouragingly with regard to the business.

Mr. F. Chevallier Boutell, the member of the Local Committee to whom the Chairman had referred, also addressed the meeting; and, in the course of his remarks, he said that the Company's district was developing in a marvellous manner, and in this respect he could not imagine a company with a brighter outlook.

The staff, both at home and in South America, were subsequently thanked for their services, as was also the Chairman.

PRIMITIVA GAS COMPANY'S CONTRACT.

Dispute with the Buenos Ayres Municipality.

A number of the "Review of the River Plate" recently to hand contains particulars of a dispute which has arisen between the Buenos Ayres Municipality and the Primitiva Gas Company as to the interpretation of the ninth clause of the contract in force between the parties; and the matter has been submitted to arbitration. The clause runs as follows: "The Company and those which amalgamate with it shall pay quarterly to the Municipality 10 per cent. of the gross revenue obtained from the sale of gas within the Municipality. The future extensions which may take place within the Municipality are included in this contract. From this tax are exempted the gas sold for public lighting and 12 per cent. for leakage of the part of the output of the works affected by this tax."

The Municipality ask: (*a*) That the Arbitration Court shall declare that the words "and 12 per cent. for leakage of the part of the output of the works affected by this tax" are null and void and without legal value. (*b*) That the leakage in the output of gas as proved in the works does not bring in any reserve subject to the 10 per cent. on the gross income, and that this tax is imposed solely on the gas sold and not on the gas manufactured. (*c*) That the Primitiva Gas Company are obliged to hand over to the Municipality the 10 per cent. of their gross revenue without discounting 12 per cent. from this; and in consequence they should pay from the date of the contract (July 30, 1909) the difference they have held back when making the quarterly liquidations on account of this 12 per cent. The Gas Company ask the Court to declare: (*a*) That the part of the ninth clause mentioned above was the basis on which the negotiations for the contract were carried through, was accepted by the Municipality and the Company as one of the constitutive parts of the agreement, and was the foundation of the advantages and rights of the Municipality, in reciprocity for obligations existing in consequence, cause, and notice for the exception. (*b*) That therefore the liquidation as effected by the Company is just, and in strict accord with the contract.

As the Company's gross revenue from the sale of gas in the past year amounted to nearly £580,000, the sum in dispute is considerable—somewhere about £7000. The award is to be given within the next three months.

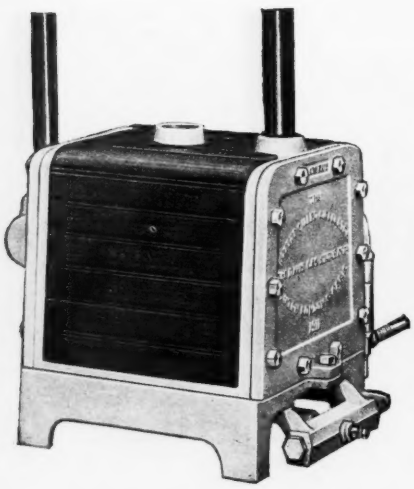
THE CHARGE FOR GAS IN BUFFALO (N.Y.).

Dispute between the Gas Company and the Corporation.

We learn from "Progressive Age" that the Public Service Commission of Buffalo have been called upon to settle a dispute which has arisen between the Buffalo Gas Company and the Corporation in regard to the price charged for gas. Complaint was made by the Company that the Corporation were withholding 25c. per 1000 cubic feet on the amount of their gas bills; these being rendered at the rate of 95c., and the Corporation offering payment at the rate of 70c. The Commission were asked to determine what was a fair and reasonable charge for gas, not only to the Corporation for public use, but also to private consumers. The matter came before them recently for consideration of the estimates of the value of the Company's property as supplied by the two parties to the dispute; and they showed considerable difference of opinion, as will be seen from the following figures:—

	Company.		Corporation.
Manufacturing plant and holders	$986,742	..	$606,460
Street mains	2,854,299	..	1,274,290
Services	831,301	..	103,055
Consumers' meters	163,885	..	103,239
Office fixtures, &c.	7,300	..	4,380
Working capital	150,000	..	150,000
Totals	$4,993,527	..	$2,241,424

These totals, which differ to the extent of $2,752,103, are exclusive of real estate and buildings. The question of valuation is important as bearing upon the price to be charged for gas; for it is admitted that the Company are entitled to a fair return upon their investment.



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The fullest details and diagrams appear in our new booklet, G.C./11, copies of which will be sent to you shortly.

CROYDON CORPORATION WATER-WORKS.

At a Home Counties District Meeting of the Institution of Municipal and County Engineers held in the Town Hall, Croydon, on the 22nd ult.—Mr. J. Paton (Plymouth), the President, in the chair—Mr. G. F. CARTER, the Borough Engineer and Surveyor and Water Engineer, submitted some notes on "The Public Works of Croydon," which included the following particulars in regard to the water-works.

The Corporation of Croydon are the water authority for the borough; and they also supply Addington and the Croydon Mental Hospital. The following are the water resources (the figures being the minimum yield per day): From high-level wells, 1,650,000 gallons; and from low-level wells, 4,000,000 gallons. In addition, a bulk supply of 500,000,000 gallons per annum—say, 1,350,000 gallons per day—is obtained from the Metropolitan Water Board; making a total average yield of 7,000,000 gallons per day. Last year, the daily average consumption was 4,701,716 gallons per day to a population estimated at 166,000, or 28·32 gallons per head, estimated as follows: Domestic purposes, 23·10 gallons; public and sanitary purposes, 3·43 gallons; meter supplies, 1·79 gallons. The high-level reservoir (on Addington Hills) holds 5 million gallons with the overflow level 465 feet above Ordnance datum; and the low-level reservoir (on Park Hill) contains 950,000 gallons with the overflow 293 feet above Ordnance datum.

The Stroud Green well (high level) is sunk to a depth of 390 ft. 6 in.; the lower 251 feet being in the chalk. It is lined to a depth of 144 feet with iron cylinders, the successive diameters of which are 12, 11, and 10 feet; the last diameter being continued in the chalk. A 12-inch borehole has been put down beyond to a depth of 537 feet from the surface. At 230 feet there are 2827 feet, and at 365 feet there are 1395 feet, of headings. The boreholes are made both upwards and downwards in both sets of headings. The well is a disappointment; the yield being only 650,000 gallons per day, and the cost of the work £38,000. However, water being urgently required, instructions were given to the author to instal pumping plant and the necessary buildings, which were opened in 1907; the cost being £20,000. The machinery consists of three Cornish boilers (160 lbs. working pressure), a triple-expansion engine of 250 H.P., two well pumps, and a set of three-throw force pumps capable of lifting 65,000 gallons per hour from a depth of 380 feet, and forcing it an additional height of 273 feet to the reservoir. On testing, the engine performed a duty of 130,000,000 lbs. of water raised 1 foot per cwt. of Welsh coal. The plant and buildings are so arranged as to contain a duplicate set of engine and pumps hereafter.

The Waddon well (low level) site was advised by the late Engineer about fourteen years ago. An application for sanction to a loan for works was made to the Local Government Board on two occasions; and on each, after a severely contested inquiry, the application was refused. The opposition was raised from riparian owners on the River Wandle, who also questioned the suitability of the site. The result was that the Corporation took up the site at Stroud Green, the well at which place yields a minimum of 650,000 gallons a day.

In 1907, the author presented a report to the Corporation upon the water question, and recommended that a well at Waddon and filtration works at Addington should be put in hand forthwith, at a cost of £30,000 and £10,000 respectively. This was adopted, and a resolution passed that the works be proceeded with, and the cost defrayed out of revenue. Other items were included in the report involving a further expenditure of about £80,000, which are now forming the subject of applications to the Local Government Board. They include a low-level covered service reservoir to hold 6 million gallons, filters, &c. The well is 8 feet diameter, sunk to a depth of 60 feet, and lined with cast-iron cylinders, beyond which, to a total depth of 190 feet, the chalk was bored 6 ft. 6 in. diameter by a single tool—*i.e.*, in one operation. In 1908, on the completion of the boring, the opponents of the well promoted a late Bill in Parliament against the scheme. The Corporation offered opposition; and an arrangement was made whereby the amount of water to be taken was limited to 50 million gallons in thirty days. The works were completed in December last. The three Cornish boilers are supplied with slack coal on the underfeed system, which the author first tried three years ago with success. The lifting plant is a cross-compound surface-condensing deep well and surface lift pumping-engine, capable of raising and forcing 130,000 gallons per hour a total lift of 340 feet. The guaranteed duty is 125,000,000 lbs. of water raised per cwt. of good Welsh coal used. The buildings are designed for extension to receive a second pumping-engine and another bored well. The water discharged from the works is measured by a Venturi meter. The 21-inch cast-iron pumping main is 2500 yards long, and was laid by direct labour.

At the Addington well, the sand filters were completed in May last year; the work being done by administration. With regard to the measures adopted for safeguarding the purity of the water, investigations were made, in conjunction with the Medical Officer of Health (Dr. Richards), of the flow of water in the chalk, and incidentally as to its quality as affected by the rate of rainfall, &c. An experimental sand filter 9 ft. by 6 ft. was constructed and worked at various rates, as well as treated with water containing known quantities of bacteria; and highly satisfactory data were obtained with clear well water. Fortunately, the pumps at the Addington well break the lift at the surface; so that, with the necessary alterations, arrangements could be made for the well pumps to deliver on to the sand filters. After passing through them, the water is discharged into a tank under the engine; and the force-pumps send it forward to the reservoir. An equilibrium valve in the tank, connected to the pumping main, ensures a supply of water to the force-pumps under all conditions. The sand filters are three in number, constructed in concrete, and each 107 ft. by 120 ft. and 7 ft. 6 in. deep. Over the floor are laid two courses of red bricks; the bottom course forming channels discharging into the main central channel. Over the bricks are laid 9 inches of clean gravel (to pass

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⅝-inch screen), 2½ inches of other gravel (to pass ⅝-inch screen), 2 inches of coarse sand, and 2 feet of fine Leighton Buzzard sand. A depth of 2 ft. 6 in. to 3 feet of water is maintained over the sand, controlled by a telescopic tube on the outlet of each filter.

At these works there has recently been completed a softening plant for the water which is forced by separate pumps to the Croydon Mental Hospital situate about three miles away. The plant has a capacity of 6000 gallons per hour, and reduces the hardness from 20° to 4·5°, or 1° above the permanent hardness. The system, which is on the Atkins principle, consists of the addition of milk of lime to the water, settlement in tanks, and passing through filter cloths. The filters and softening plant were constructed by direct labour, at a cost of about £11,000.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On the evening of Friday of last week, a large company of gas managers in Scotland met in the banqueting hall of the George Hotel, Kilmarnock, to do honour to Mr. W. Fairweather, the Gas Engineer and Manager in that town. Mr. D. Robertson, of Dunoon, who presided, said that Mr. Fairweather occupied a unique place in the hearts of all who enjoyed the privilege of his acquaintance. His kind words and still kindlier deeds had endeared him to all of them; and apart from his sterling qualities of heart and mind, his genial presence and his inspiring conversation had made intercourse with him one of life's pleasures which none of them would willingly forego. The duties of a gas manager were certainly full of responsibility, and at times irksome; but their friend had risen superior to them all, and had made his mark wherever he had been. In Dunoon, in Barrhead, and in Kilmarnock, his professional services had been highly valued, and justly so; for it would be difficult to find in one individual such thorough technical skill allied with a more modest and unassuming nature. He thought they would agree with him that these excellent qualities of their guest deserved some special recognition; and they were very proud indeed to hand to Mr. Fairweather an illuminated address, signed by many sincere friends among his professional brethren, as a token of their love and regard for him. The address contained the following passages: "We, your fellow-managers of gas-works in Scotland, desire to offer you our hearty congratulations on the completion of twenty-five years' successful management of the Corporation gas-works, Kilmarnock. We, who are in charge of other gas-works in Scotland, feel a great debt of gratitude to you for the privilege we have long enjoyed of calling upon you and receiving your counsel and advice and the benefit of your ripe experience, to which we have always been made welcome. We embrace this opportunity of congratulating you upon the completion of the engineering and constructional work connected with the transfer of the gas manufacturing station in Kilmarnock from Langlands Street to the river bank at Riccarton, which has proved to be such an unqualified engineering and financial success." The signatures affixed numbered thirty-three. Mr. Fairweather, in a few appropriate words, acknowledged the kindly presentation. Mr. J. W. Carmichael, of Barrhead, presented Mrs. Fairweather with a silver fruit-stand, as a memento of her twenty-five years' sojourn in Kilmarnock. Mr. C. Fairweather accepted the gift on behalf of his mother, and returned thanks for it. The toast of "The Corporation of Kilmarnock" was proposed by Mr. J. B. Scott, of Cowdenbeath, and acknowledged by Provost Smith. "Success to the Kilmarnock Gas-Works" was proposed by Mr. T. Watson, of Girvan, and was responded to by Bailie Robert Muir, the Convener of the Gas Committee of the Town Council. Other toasts were honoured, and a very enjoyable social evening was spent on a unique occasion.

At the end of last week, the Water Committee of the Aberdeen Town Council, along with the members of the Council who were elected last November, paid a visit to the various places in the valley of the Dee where it has been found to be necessary to make arrangements for the prevention of pollution of the river by the discharge of sewage into it. Two days were spent in the tour of inspection; Aberdeen being reached on the return at a somewhat late hour on Saturday evening. It is stated that the general opinion of the party appeared to be that, although there were several sources of pollution which would require attention, the state of matters was not so serious as was expected to be found. It is acknowledged that everything is not as it should be; but it is felt that it will not require such a heavy expenditure as has been stated to put matters right. There is, it is believed, evidence of carelessness in some cases; and need of more careful supervision generally being given to the sources of pollution. There is a feeling of general satisfaction with the result of the visit. The visit, it may be said, has been the object of considerable adverse criticism; the party in the Town Council who wish to have an entirely new source of supply seeing in it an attempt to bolster up as sufficiently pure the existing supply from the River Dee.

Although statutory power to do the work is expected to be not given till June, the Corporation Water Department in Dundee have for several months been engaged in preliminary work in connection with the increase of the water supply to the city and district. The principal work to be undertaken is that of raising the level of Lintrathen Loch by 4 feet, thus increasing its storage capacity from 1,614,000,000 to 2,100,000,000 gallons. This quantity, it is estimated, will be sufficient for the needs of the populace during the next fifty years. The raising of the level of the loch involves the diversion of about a mile and a half of road. This work has been in progress for some time, as well as the opening up of two quarries from which to obtain stone for banking and other purposes. The new works are estimated to cost about £15,000, and to occupy some two years in construction.

Messrs. D. Hulett and Co., Limited, have been successful in obtaining the contracts from the War Office for wrought-iron gas and water tubes and fittings, and also for brass gas-fittings for a period of three years.

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The Gas Roaster illustrated has been supplied for the kitchens at the SCOTTISH EXHIBITION of History, Art and Industry (Glasgow), 1911, to H.M. GOVERNMENT ESTABLISHMENTS, and the leading HOTELS, PUBLIC INSTITUTIONS, &c.

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CARRON, STIRLINGSHIRE.

CURRENT SALES OF GAS PRODUCTS.

[For Table of "Tar Products Prices," see p. 327.]

LIVERPOOL, *April* 29.

Sulphate of Ammonia.

In the early part of the week the competition for all immediate supplies was decidedly keen, and in some instances very full prices were paid. The bulk of the purchasing has been done by dealers who still had contracts open for April shipment; and, their requirements having been filled, the demand has fallen away to some extent within the past two days. The nearest values at the close are £13 12s. 6d. to £13 13s. 9d. per ton f.o.b. Hull, £13 13s. 9d. to £13 15s. per ton f.o.b. Liverpool, and £13 16s. 3d. to £13 17s. 6d. per ton f.o.b. Leith. In the forward position, there has not been much interest shown, consumers preferring to wait till later on in the hope of buying cheaper. It is reported, however, that first-hand business has been done over the whole of 1912 at something above the equivalent of £13 per ton f.o.b. at the ports.

Nitrate of Soda.

This commodity has experienced good inquiry, and holders continue very firm at 9s. 9d. per cwt. for 95 per cent. quality and 10s. for 96 per cent. quality, on spot.

LONDON, *May* 1.

Tar Products.

The markets for tar products have remained steady during the past week. There has been an improvement in the demand for pitch, both for this and next season's delivery; but prices continue unchanged. Benzols remain in about the same position; buyers being very reluctant to pay the prices asked. Solvent naphtha is steady. There has been a little more inquiry for creosote, and in some quarters improved prices have been asked. The position is unaltered in crude carbolic.

The average values during the week were: Tar, 17s. 9d. to 21s. 9d., *ex* works. Pitch, London, 36s. to 36s. 6d.; east coast, 35s. 6d. to 36s. 6d.; west coast, Manchester, 35s. 6d. to 36s., Liverpool, 36s. to 36s. 6d., Clyde, 36s. to 36s. 6d. Benzol, 90 per cent., casks included, London, 8¾d. to 9¼d.; North, 8½d. to 9d.; 50-90 per cent., casks included, London, 9d. to 9½d.; North, 8½d. to 9d. Toluol, casks included, London, 9¾d.; North, 9½d. to 9½d. Crude naphtha, in bulk, London, 4d. to 4¼d.; North, 3¼d. to 3½d.; solvent naphtha, casks included, London, 11½d. to 1s.; North, 10½d. to 11d.; heavy naphtha, casks included, London, 1s. to 1s. 0½d.; North, 10½d. to 11d. Creosote, in bulk, London, 2¼d. to 2⅜d.; North, 1⅞d. to 2d. Heavy oils, in bulk, 2⅜d. to 2¾d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 7d. to 1s. 8d.; west coast, 1s. 6½d. to 1s. 7½d. Naphthalene, £4 10s. to £8 10s.; salts, 40s. to 42s. 6d., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

There has been a little more buying during the past week, and no doubt purchases have been made to cover in deliveries for the month. Actual Beckton to-day is quoted £13 2s. 6d. Outside London makes are £13; Hull, £13 13s. 9d.; Liverpool, £13 13s. 9d.; Leith, £13 16s. 3d.; and Middlesbrough, £13 12s. 6d.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a steady demand for steam coals, and that for gas coals is very full just now. In steam coals, best Northumbrians are from 10s. 6d. to 10s. 9d. per ton f.o.b., second-class steams are from 9s. to 9s. 3d., and steam smalls are 5s. to 6s. 3d. Some large orders are in the market, and the current production appears to be well taken up at present. In the gas coal trade, the demand is very good for export, though the home requirements show the decrease that is customary with the lengthening days. Durham gas coals vary in price, according to quality. The usual classes are from 8s. 9d. up to 9s. 9d. per ton f.o.b.; while for "Wear specials," the current price is now about 10s. 9d. to 10s. 10½d. per ton. There are heavy shipments of gas coal being made; and the two chief shipping places were congested with steamers a few days ago—the recent high freights having induced some shippers to retain as long as possible the carrying out of orders. No additional contracts of moment are reported this week; but one or two cargoes have been sold for forward delivery at something like the prices above quoted for current sales. The coke trade is steady. Gas coke maintains its price at from 13s. to 13s. 3d. per ton f.o.b.

Scotch Coal Trade.

Trade has shown a tendency to improve. The season for coal contracts is getting over, with the result that there is less disposition to conceal quotations. Generally speaking, there is a slight reduction upon last year's prices, which were affected by the recent establishment of the eight-hours' day for miners; whereas now the extent of the influence of this step has been fully gauged. It is reported that the Baltic is in great part open for navigation, which also gives some zest to the foreign demand. The prices now quoted are: Ell, 9s. to 9s. 9d. per ton f.o.b. Glasgow; splint, 9s. 9d. to 10s.; and steam, 9s. to 9s. 3d. The shipments for the week amounted to 356,366 tons—an increase of 26,288 tons upon the previous week, and of 34,083 tons upon the corresponding week last year. For the year to date, the total shipments have been 4,648,029 tons—a decrease upon the corresponding period of 16,541 tons.

The Gas Committee of the Bolton Corporation have agreed to a request made to them by the gas-fitters in the employ of the Gas Department that they should be placed on the same terms as regards overtime, holidays, &c., as the fitters in the Electricity Department.

We have for many years directed our attention to the designing and perfecting of

HOTEL COOKING APPLIANCES

with a view to producing a higher type of Apparatus than had hitherto been placed on the market. These Appliances, which form the latest and by far the best Apparatus of this class yet introduced, are the outcome of our exceptional equipment, mature knowledge of Gas-Stove Construction, and an experience of forty-five years.

Our new Illustrated Price List will be sent post free on request.

This Illustration shows a special Apparatus consisting of a "ROSTRUM" Roasting Oven, three "BORDO" Ovens, a "CITO" Single Grill, and a Boiling Table with Overhead Plate Rack.

This is only one of many combinations that we can supply to suit special requirements.

JOHN WRIGHT & CO.,
Essex Works,
BIRMINGHAM.

Position of Sulphate of Ammonia.

The following remarks, from a special correspondent, appeared in the "Financial Times" last Thursday: "More than usual interest attaches to the present position of sulphate of ammonia. The price has for some time past been at an unusually high level; but there has latterly been some reaction, encouraged possibly to some extent by the announcement that there is likely to be a considerable increase of the output from coke-ovens, several batteries of which have recently been ordered. Those extensions may not affect the output for the current year, but they will certainly have a considerable influence on the production during 1912. There are a good many producers in Great Britain, and to some of them—notably the Scottish mineral oil companies—sulphate of ammonia is a very important bye-product indeed. In the oil trade, the forthcoming reports will probably show that it has been the main stand-by so far as profit-earning is concerned. The price was recently well over £14 per ton; and though it has since receded somewhat, it still shows a very handsome margin of profit, the cost of production being about £4 or £5 per ton. Great Britain and Germany now practically tie for first place among producers, though the latter had it last year with 373,000 tons, against Great Britain's 369,000 tons. The United States produced 116,000 tons; France, 56,000 tons; Belgium and Holland, 43,000 tons; the rest of the world, 100,000 tons."

Winsford Gas Undertaking.—In his annual report to the Winsford Urban District Council as to the gas undertaking, Mr. F. Sidwell, the Manager, states that the make of gas for the twelve months to March last amounted to 30,586,400 cubic feet; the increase being 5·65 per cent. The quantity sold to consumers was 26,787,036 cubic feet, representing an increase of 5·42 per cent. The gas used by engineers and plant on the works was 1,147,720 cubic feet; and the amount unaccounted for, 2,651,644 cubic feet, or 8·34 per cent. The coal carbonized was 2459 tons 10 cwt., and cannel 244 tons 11 cwt.—an increase of 127 tons 19 cwt. The average make of gas per ton of coal carbonized was 11,311·32 cubic feet; being 73·41 cubic feet per ton increase over the previous year.

Reductions in Price.—The Yeovil Corporation have reduced the price of gas 2d. per 1000 cubic feet as from the 31st of March; making it 3s. net. Ordinary consumers will have the concession in the shape of an increased discount, and the prepayment consumers will have a rebate of 2d. instead of 1d. in the shilling. The annual charge for each street lamp will be reduced by 1s. 4d. The Shepshed District Council have reduced the price of gas 3d. per 1000 cubic feet. On the recommendation of the Gas Committee, the Skipton Urban District Council have decided to reduce the price of gas to ordinary consumers in Skipton from 2s. 8½d. to 2s. 6d. per 1000 cubic feet, and to ordinary consumers in Carleton and Embsay from 3s. 1½d. to 2s. 11d. from the 1st ult. Slot-meter users in Skipton are to have a reduction to 2s. 8d. per 1000 cubic feet, and those in Carleton and Embsay a reduction to 3s. 1d.

Association of Engineers-in-Charge at Beckton.

Last Saturday, about fifty members of the Association of Engineers-in-Charge availed themselves of the invitation of the Directors of the Gaslight and Coke Company to visit their extensive works at Beckton. The party were received by Messrs. Cassey and Warren, under whose guidance the inspection was carried out. To enable this to be done more expeditiously, arrangements had been made for conveying the members to the various points of interest by means of the works railway; and, in this way, a much more exhaustive examination was possible than would otherwise have been the case. At the conclusion of the inspection, the party adjourned to the Rifle Range in connection with the works, where a substantial tea had been very thoughtfully provided. Mr. A. E. Penn (the Chairman of the Association) took the opportunity of expressing, on behalf of the visitors, their best thanks for the excellent arrangements that had been made, and which had resulted in such an enjoyable and instructive visit. Mr. J. N. Reeson (the Resident Engineer), in replying, spoke of the pleasure it afforded him to see so many present, and to know that the visit had been so much appreciated. After an inspection of the Rifle Range, the party separated.

Gas-Meters in Rooms.—The placing of gas-meters in rooms devoted to living or sleeping was condemned last Wednesday by a Coroner's Jury at Ryde. George Henry Faithfull, 24 years of age, had four days previously returned to his mother's house in the town, and two days later he was found dead in his bedroom, which was filled with coal gas. It was subsequently ascertained by those who had rendered assistance that the gas had escaped from the meter in the room; the union having been loosened very considerably. The verdict was "Accidental poisoning by coal gas." The condemnation already alluded to being contained in a rider.

Price of Gas at Newport (Mon.).—There has lately been formed at Newport (Mon.) a Gas Consumers' League; and the first public meeting under their auspices was held last Tuesday evening. There was a large and representative gathering. The Secretary (Mr. J. T. Evans) explained the object of the League, which was to secure cheaper gas for the consumers. There was no suggestion of advocating municipalization of the gas-works; in fact, some of the members were opposed to it. For the moment they were simply agitating; and he thought the time had come when the gas consumers should protest with a loud voice against the high charges of the Gas Company. Practically every large consumer had decided to join the League, which now had some 1500 members. The following resolution was carried unanimously: "That this meeting of gas consumers records its protest against the present high price of gas in Newport; approves of the objects of the Newport Gas Consumers' League; and pledges itself to assist the League in enrolling members, so that when its plans are matured they will be able to speak on behalf of a large body of consumers, and take such action as advised to secure cheaper gas for Newport."

BRADDOCK'S

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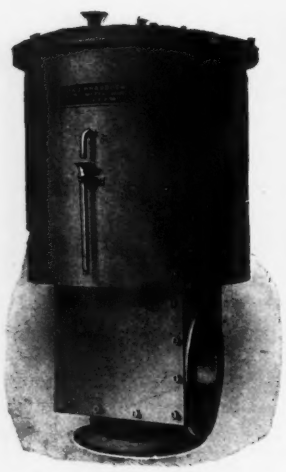
GOVERNORS.



No. 193.
Braddock's Enclosed Retort-House Governor, with Internal Float.

SECOND TO NONE.

For Efficiency and Reliability.

Many Repeat Orders have been received.

No. 244. Braddock's Enclosed Retort-House Governor, Beam Type.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), Globe Meter Works, OLDHAM,

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 815.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE, LONDON." Telephone No. 2412 HOP.

Sales of Stocks and Shares.

At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards placed three new issues of capital by order of Directors. The first consisted of £2500 of 5 per cent. ordinary (1901) stock and £7500 of 5 per cent. preference stock of the South Essex Water-Works Company. The former was all sold at £117 to £118, and the latter at £126 to £127, per £100. The next issue consisted of 250 £10 new ordinary shares, and £2500 of 4½ per cent. perpetual debenture stock of the Ascot District Gas and Electricity Company. The shares rank for a maximum dividend of 7 per cent.; but on existing similar shares 5½ per cent. is being paid. They fetched £10 5s. to £11 apiece; and the stock was all sold at £100 to £101 per £100. A new issue of £2400 of 5 per cent. perpetual debenture stock of the Whitchurch and District Gas Company, Limited, was placed at par to £100 10s. per £100. On the same occasion, Messrs. A. & W. Richards sold some fully-paid "D" ordinary shares in the Limpsfield and Oxted Water Company, carrying 7 per cent. dividend, at £14 15s. to £15 per share; a few £10 fully-paid "C" shares in the Chertsey Gas Consumers' Company, Limited, ranking for a standard dividend of 10 per cent., but carrying 2 per cent. more, at £26 each; and some fully-paid £25 shares (7 per cent., but carrying 9 per cent.) in the same Company, at £46 15s. a piece. At a recent sale by Messrs. Winch and Sons, at Cranbrook, three £10 shares in the local Gas Company fetched £62.

Reduction in Price at Reading.—The Directors of the Reading Gas Company have announced that from the 31st of March last the price of gas throughout their area of supply has been reduced to all ordinary consumers by 1d. per 1000 cubic feet, making it 2s. 5d.; and that immediate steps will be taken to give the full benefit of the reduction to all prepayment consumers. This concession is equal to a saving to the consumers of £2500 per annum, and, coupled with the reductions made in the years 1906, 1907, and 1909, results in a total reduction in five years of upwards of £13,000 per annum in the Company's charges for gas. In the year 1903, the price was 3s. It may be mentioned that no meter-rents are charged at Reading.

The Business of the Late Sir John Aird.—In the Chancery Division of the High Court of Justice last Tuesday, Mr. Justice Neville had before him a petition in the matter of the Westminster Construction Company, Limited, to alter the Memorandum of Association of the Company so as to include the business established by the late Sir John Aird. Counsel said this was one of the Companies in which the deceased carried on his business. The Company were general contractors for works; and the capital was £200,000, in 20,000 shares of £10 each. They had issued half the capital, on which £6 10s. per share had been paid. Owing to the death of Sir John Aird, the Company had the opportunity of taking over his business; and they proposed to acquire it by purchase. His Lordship sanctioned the alteration applied for.

West Bromwich Gas Undertaking.—The Gas Committee of the West Bromwich Corporation have issued a satisfactory report on the working of the undertaking for the past financial year. It shows that the sales of gas were 331,850,219 cubic feet—an increase of 10,343,611 cubic feet as compared with the preceding year; and the gas-rental was £40,019, or £1110 more than before.

Gas-Meter Testing in Birmingham.—According to the report of the Gas-Testing Committee presented at the meeting of the Birmingham City Magistrates last Thursday, the number of gas-meters tested in the year ended the 31st of March was 50,033; being an increase of 2338 compared with the preceding twelve months. The fees were £61 10s. 4d. higher; and there was a balance of £691 10s. on the year's account.

Rochdale Gas and Electricity Profits in Aid of Rates.—A special meeting of the Rochdale Town Council, held last Wednesday, decided to take from the gas and electricity profits in aid of rates £17,000, instead of £16,500 as recommended by the Gas and Electricity Committee. The extra £500 will be taken from the Electricity Department; making the amount £5000 in place of £4500. The sum to be allocated from gas profits remains as proposed by the Committee—viz., £12,000, compared with £9000 for the year 1909-10. The price of gas will remain at 2s. 8d. per 1000 cubic feet—a figure at which it has stood since 1906, when a reduction of 2d. was agreed to.

Salford Gas Charges.—At the meeting of the Salford Town Council to-morrow, Mr. Purcell, one of the Labour members, will move the following resolution: "That the Gas Committee be instructed to so arrange the charges for gas in the borough, as from the 1st of July next, that the price to ordinary meter users shall be 2s. 3d. per 1000 cubic feet; and for prepayment-meter users, the meters to be so altered as to give 33 cubic feet of gas for 1d." It is argued by Mr. Purcell and his supporters that the Gas Committee can well afford to make this concession to consumers, especially as for the current year the Gas Department will be paying 6d. per ton less for coal than last year, representing a saving of £4000 on raw material. It is also pointed out that the Manchester Gas Committee are now giving 33 cubic feet of gas for 1d. to slot-meter users, against Salford's 30 cubic feet.

Bermondsey Electric Light Order Refused.—The Board of Trade have declined to grant a Provisional Order applied for by the Bermondsey Borough Council to enable them to extend their lighting area into the parish of St. Olave, which includes Tooley Street. An inquiry into the matter was held by Mr. H. J. Tennant, M.P., the Parliamentary Secretary to the Board, at which Mr. Balfour Browne, K.C., and Mr. Courthope Munroe represented the South Metropolitan Gas Company. A considerable quantity of evidence was given in opposition to the proposed extension. The Gas Company succeeded in getting inserted in the Draft Order a clause similar to the one in the Rotherhithe Order of 1902, prohibiting the charging upon the rates of any deficiency in the income of the Council from the supply of electricity. Their action was commendable; that of the Board of Trade is possibly more so, as far as the ratepayers are concerned.

PARKINSON'S

"HOLBORN" CIRCULATOR

See next Advertisement May 16, for Sectional Description.

SPECIAL POINTS.

Made of Strong Copper—cannot rust.

Only one Water Chamber—no Connections to leak.

Interior removable—all parts open for cleaning—only one joint to replace.

Thermostatic Valve fitted if required.

THE PARKINSON STOVE CO., LTD.

(Incorporating Maughan's Patent Geyser Co.),

BIRMINGHAM AND LONDON.

BEST RESULTS.

LEAST GAS.

MOST PRACTICAL CONSTRUCTION.

The Water Question at Southampton.—At the meeting of the Southampton Town Council last Wednesday, it was resolved to send a deputation from the Parliamentary and Water (Joint) Committee to meet the Directors of the South Hants Water Company to discuss the questions of the sale of their undertaking to the Corporation and the supply of water in the borough.

Additional Capital for the Leatherhead and District Water Company.—The issue of 300 £10 shares and £2000 of 4 per cent. debenture stock of this Company for which tenders were recently invited in our advertisement columns was considerably over-subscribed for. The average price of the accepted tenders was £14 8s. 3d. for each £10 share (maximum dividend 7 per cent.), and £103 10s. for each £100 lot of debenture stock.

An Absconding Gas Manager.—At the meeting of the Wolstanton Urban District Council last Wednesday, it was reported that Mr. A. A. T. Botteley, the Engineer and Manager of the gas-works, had been suspended, and had subsequently absconded. A relative had agreed to pay the sum of £253, the amount of the various cash balances of the Manager. It was explained that he had been doing certain work which was not in the requisition-book, and was intercepting some letters that came to the gas-works.

Suicide of a Gas Company's Official.—Mr. Stephen J. Symonds, the Engineer, Manager, and Secretary of the Farnham Gas and Electricity Company, committed suicide last Thursday under somewhat extraordinary circumstances. He travelled from Charing Cross Station by the 3.18 p.m. train for Dover in a third-class compartment, in which there were several other passengers. He entered the lavatory, and immediately afterwards there was the sound of smashing glass, and a heavy thud. The door was tried, but it was locked. The communication cord was pulled just after passing Paddock Wood Junction, the train stopped, and a message sent to Marden for a doctor to be in readiness. At Marden the lavatory door was broken open, and inside was found the dead body of a well-dressed man, who presented a horrible sight. He had smashed the water-bottle, and with the broken glass had severed an artery in his wrist and inflicted a deep wound in the lower part of his throat. The body was taken on to Ashford.

The "London and Provincial Magazine" for the current month contains an article on the business of Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees, accompanied by reproductions of photographs of various portions of their Parkfield Works.

The Daventry Gas and Coke Company have placed with Messrs. Edward Cockey and Sons, Limited, of Frome, an order for a gasholder and steel tank. Messrs. Cockey have also been successful in securing a contract for a new retort-bench—seven beds of eight retorts, with all the iron and steel work complete, for the Frome Gas Company.

The Richmond Gas Stove and Meter Company, Limited, have sent us one of their new season's cooker booklets, containing particulars of some of their latest productions, among which are the "New Crusader" and the revised "Belfast" on stand. The cover is somewhat similar to that of last year's booklet, and is an artistic production, printed in eight colours.

The Lewisham Borough Council have considered applications from the South Metropolitan Gas Company for authority for the erection of 34 high-pressure lamps and columns in High Street, Lewisham, 66 at Rushey Green, and 39 in the High Road, Lee. The requisite permission is to be granted except in cases where the Borough Engineer considers that the footpath is of insufficient width.

Mr. Charles Carpenter (the Chairman) and Mr. F. M'Leod (the Secretary) of the South Metropolitan Gas Company have consented to serve on the Provisional Committee carrying out the arrangements in connection with "Camberwell Day" in the Pageant of London; and they will also arrange to open fifteen places for the sale of tickets at the Company's works and offices. The Company cannot, however, take part in the affair.

An exhibition of microscopes and microscopical studies was held at the West Greenwich Gas-Works Institute last Tuesday evening, under the direction of Mr. Henry Austin, assisted by Messrs. Charlton (Messrs. Leitz' representative), H. Colebrook, Charles T. Drumgold, Moorey, and Read. Thirteen microscopes were on view, including a new invention—the fumescope—all of which were explained. They were inspected by many visitors, among whom were Mr. J. F. Braidwood, the Engineer-in-Charge of the West Greenwich station of the South Metropolitan Gas Company (President of the Institute), Messrs. J. D. C. Hunter and W. H. Cupitt (Employee Directors of the Company), and W. T. Layton (Editor of the "Co-Partnership Journal"). At the instance of Mr. Braidwood, seconded by Mr. Hunter, Mr. Austin and his assistants were cordially thanked. Mr. Austin, in reply, said he had never seen a better exhibition; and he wished to thank those who had helped him, and also Messrs. Leitz, for the use of their extremely interesting instruments.

A link with the early days of geysers was recently severed by the death, in his 63rd year, of John Dennett, who, as a young man entered the employ of Mr. B. W. Maughan (the original inventor of instantaneous water-heaters), and during forty years of regular service witnessed the evolution of the "Maughan geysers" from the early types to the latest developments. His work included all branches of manufacture, and also a great variety of fixing work, in which his ingenuity was frequently displayed in overcoming the inevitable difficulties of a "pioneer." His wide experience made him an authority on all practical points; and it was of great assistance in the constant growth and development of the trade. On the acquisition of the business by the Parkinson Stove Company, Limited, Mr. Dennett was appointed foreman of the department at the Birmingham works, where he was actively engaged in instructing the many new workmen employed in consequence of the rapid increase of the business. Despite his age and long service, he was keenly interested in all new developments; and it was while he was engaged with the Manager of the hot-water section (Mr. T. E. Barralet, under whom he had worked for many years) in testing one of the latest patterns, that he was seized with a heart attack which ended fatally.

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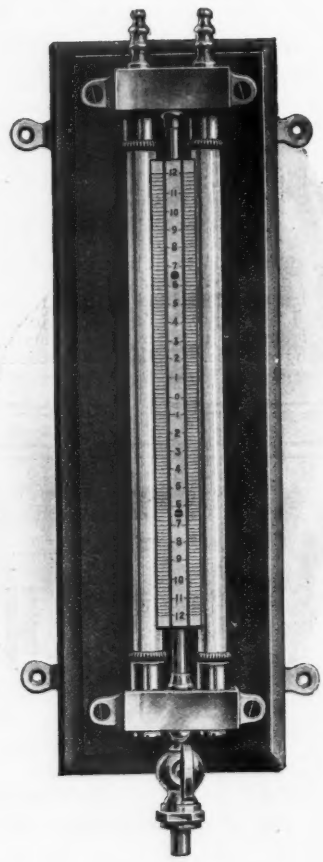
All Sizes.

For all Purposes.

Enquiries Solicited.



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WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER. No. 5390.
DRAUGHTSMAN (CHIEF). Box 26, Burton's, Aldwych.
DRAUGHTSMAN. No. 5389.
DRAUGHTSMAN. No. 5394.
TRAVELLER. W. Edgar, Hammersmith.
REPRESENTATIVE. Parkinson Stove Company.
CANVASSERS. No. 5392.

Situations, &c., Wanted.

ENGINEER IN CHARGE OR REPRESENTATIVE. No. 5391.
SULPHATE PLANT REPAIRER, &c. Davies, Shepherd's Bush.

Stocks and Shares.

EAST GRINSTEAD GAS AND WATER COMPANY. By Auction. May 9.
MAIDSTONE GAS COMPANY. By Auction. May 9.
MERTHYR TYDFIL GAS COMPANY. By Tender. May 11.
SOUTHEND WATER-WORKS COMPANY. By Auction. May 9.
SOUTHGATE GAS COMPANY. By Auction. May 9.
TENDRING HUNDRED WATER COMPANY. By Auction. May 9.
WANDSWORTH AND PUTNEY GAS COMPANY. By Auction. May 23.

Plant, &c. (Second-Hand), For Sale.

BRIDGE PIPES, ASCENSION PIPES, MOUTHPIECES, &c. John Adams and Sons, Newcastle-on-Tyne.
EXHAUSTER, ENGINE, &c. Blyth and Cowpen Gas Company.

TENDERS FOR

Benzol and Benzolized Creosote.

LEIGH GAS & WATER DEPARTMENT. Tenders by May 17.
WALSALL GAS DEPARTMENT. Tenders by May 20.

Coal and Cannel.

BRIDGNORTH GAS DEPARTMENT. Tenders by May 13.
CHORLEY GAS DEPARTMENT. Tenders by May 16.
DENTON GAS DEPARTMENT. Tenders by May 6.
ELSECAR, WENTWORTH, AND HOYLAND GAS COMPANY. Tenders by May 10.
LEIGH GAS AND WATER DEPARTMENTS. Tenders by May 17.
TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 27.
UXBRIDGE GAS COMPANY. Tenders by May 16.
WORKINGTON GAS COMMITTEE. Tenders by May 20.

Coke.

ARBROATH GAS CORPORATION.

Gas-Works Concessions and Extensions.

ODESSA CORPORATION. Tenders by June 10/23.

General Stores (Lead Piping, Vitriol, Lime, Benzol).

LEIGH GAS AND WATER DEPARTMENT. Tenders by May 17.
TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 27.
WALSALL GAS DEPARTMENT. Tenders by May 20.

Meters.

TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 27.

Painting Gasholders, &c.

CHICHESTER GAS COMPANY.

Pipes, &c.

LEIGH GAS AND WATER DEPARTMENT. Tenders by May 17.
TYLDESLEY URBAN DISTRICT COUNCIL. Tenders by May 27.

Tar and Liquor.

CANTERBURY GAS AND WATER COMPANY. Tenders by May 6.
DENTON GAS DEPARTMENT. Tenders by May 6.
MACCLESFIELD GAS COMMITTEE. Tenders by May 13.

Washer.

CHORLEY GAS DEPARTMENT. Tenders by May 16.

TAR PRODUCTS PRICES.

Representative manufacturers give the following as fair current values for the week ending April 29. Prices are net, and they include the usual packages and delivery f.o.b., f.a.s., or f.o.r., as customary.

Article.	Basis.	London.	North-East Coast.	East Coast, Yorks.	West Coast,		Glasgow.
					Liverpool.	Manchester.	
Tar crude	per ton	—	18/6 21/6	18/6 22/-	19/- 21/3	19/- 21/3	—
Pitch	,,	37/6	35/6 36/-	35/9	36/6	36/-	35/6
Benzol, 90%	per gallon	-/10 -/10½	-/9	-/9	-/9	-/8¾	-/9
Benzol, 50-90%	,,	—	-/9¼ -/9½	-/9½	-/8¼	-/8⅜	—
Toluol, 90%	,,	—	-/9¼ -/10	-/10	-/9¼	-/10	-/10
Crude naphtha, 30%	,,	—	-/3¾	-/4	-/3⅜	-/3½	—
Light oil, 50%	,,	—	-/3½	-/3¾ -/4	-/3¼	-/3⅜	—
Solvent naphtha, 90-160	,,	1/-	-/10½	-/10	-/10	-/10¼	-/11
Heavy naphtha, 90-190	,,	—	-/11	-/11½	-/11	-/11 -/11¼	-/11
Creosote in bulk	,,	-/2½	-/2⅛	-/2	-/2⅛	-/2⅛	-/1⅞
Heavy oils	,,	—	-/2¾	-/2¼	-/2⅝ -/2¾	-/2⅝ -/2¾	-/2¾
Carbolic Acid, 60's	,,	1/8½	1/7½	1/7	1/7	1/7	1/8½
Naphthalene, crude drained salts	per ton	—	42/6 45/-	40/- 42/6	45/-	45/- 47/6	—
,, pressed	,,	—	60/-	63/-	57/6	60/- 72/6	—
,, whizzed	,,	—	—	—	68/9 71/3	60/- 75/-	63/-
Anthracene	per unit	-/2	-/1¼	-/1½	-/1¾	-/1¾	—

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Resists 4500° Fahr. Best for GAS-WORKS.
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The appointment of Collector, included in the same advertisement, is still under consideration.

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Apply, by letter, giving full Information regarding Experience, Salary required, &c., to William Edgar, Blenheim Works, Hammersmith.

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Every kind of Dismantling Work Executed.

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James Burch,
Secretary and General Manager.
April 26, 1911.